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IN THIS ISSUE

ORIGINAL ARTICLES:

- SKIN GRAFTING OF BURNS ..... *Clifford L. Kiehn, M.D., and John D. DesPrez, M.D.*
- PSYCHIATRY IN INDUSTRY AS SEEN BY AN INDUSTRIAL PHYSICIAN ..... *E. F. Buyniski, M.D.*
- APPLICATION OF WORKMEN'S COMPENSATION LAWS TO RADIATION INJURIES ..... *John K. Dane*
- FUNCTIONS AND AIMS OF THE UNITED WIRE, METAL AND MACHINE MEDICAL CENTER ..... *Bernard Rothbard, M.D.*
- A HEALTH HAZARD ASSOCIATED WITH EPOXY RESIN-CONCRETE DUST ..... *R. E. Joyner, M.D., and W. Leak Pegues*
- SOME OBSERVATIONS ON PERIODIC EXECUTIVE HEALTH EXAMINATIONS ..... *Charles E. Thompson, M.D., Earl A. Zaus, M.D., and Philip R. Keller*

SURGICAL REVIEW:

- THE TREATMENT OF INDUSTRIAL HAND INJURIES— IV. AMPUTATIONS ..... *Burton C. Kilbourne, M.D., and Eudell G. Paul, M.D.*

Complete Table of Contents on Page 3*a*

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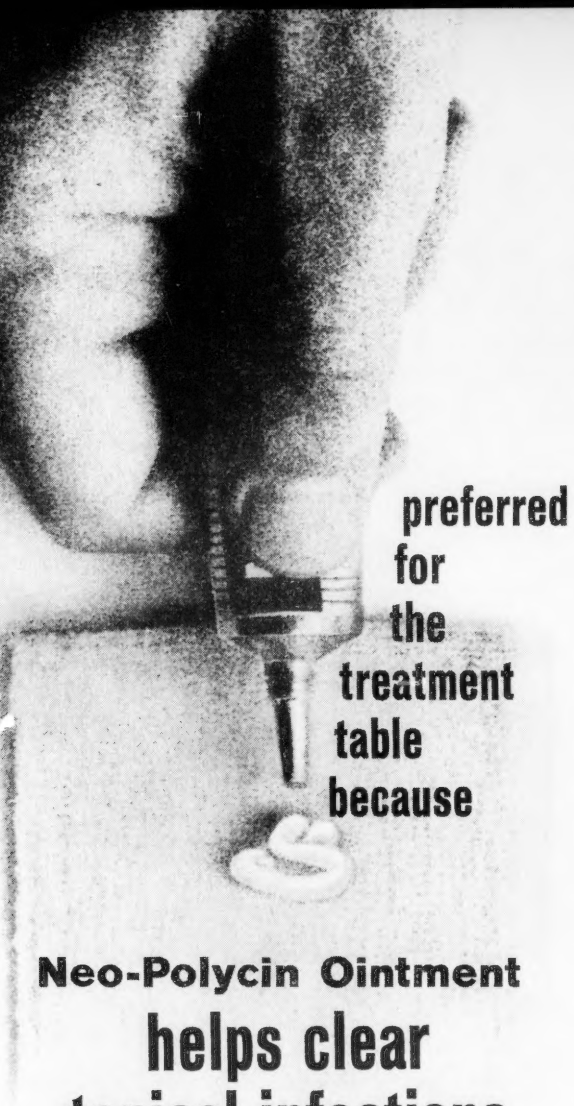

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Vol. 3 No. 4

Journal of Occupational Medicine

ISSUE OF APRIL 1961

Official Publication of the Industrial Medical Association

TABLE OF CONTENTS

TEXT SECTION

Original Articles

SKIN GRAFTING OF BURNS....193
Clifford L. Kiehn, M.D., and John D. DesPrez, M.D., Cleveland, Ohio

PSYCHIATRY IN INDUSTRY AS SEEN BY AN INDUSTRIAL PHYSICIAN....198
E. F. Buyniski, M.D., Cincinnati, Ohio

APPLICATION OF WORKMEN'S COMPENSATION LAWS TO RADIATION INJURIES....203
John K. Dane, Boston, Mass.

FUNCTIONS AND AIMS OF THE UNITED WIRE, METAL AND MACHINE MEDICAL CENTER....209
Bernard Rothbard, M.D., New York, N.Y.

A HEALTH HAZARD ASSOCIATED WITH EPOXY RESIN-CONCRETE DUST....211
R. E. Joyner, M.D., and W. Leak Pegues, Texas City, Tex.

SOME OBSERVATIONS ON PERIODIC EXECUTIVE HEALTH EXAMINATIONS....215
Charles E. Thompson, M.D., Earl A. Zaus, M.D., and Philip R. Keller, M.B.A., Chicago, Ill.

Surgical Review

THE TREATMENT OF INDUSTRIAL HAND INJURIES—IV. AMPUTATIONS....218
Burton C. Kilbourne, M.D., and Eudell G. Paul, M.D., Chicago, Ill.

Editorial

DON'T LET IT PASS....223

Book Reviews....224

Questions....226

Publications Available....227

Abstracts of Current Literature

INTERNAL MEDICINE....228

MEDICAL CARE ADMINISTRATION....229

CLINICAL TOXICOLOGY....230

NOISE AND HEARING....231

SURGERY....231

RADIATION HEALTH....233

DERMATOLOGY....234

INDUSTRIAL HYGIENE CONTROLS....235

EXPERIMENTAL TOXICOLOGY....236

GENERAL SECTION

About the Authors....*13a*

People and Events....*15a*

Directory of Advertisers....*20a*

IN COMING ISSUES

PERSONAL RESPONSIBILITY IN ACCIDENTS
Gerald Gordon, M.D., Wilmington, Del.

AUTOCATALYSIS OF PULMONARY EDEMA
Paul Gross, M.D., Marian L. Westrick, Ph.D., and James M. McNerney, M.P.H., Pittsburgh

INDUSTRIAL MEDICAL ASPECTS OF THE ACUTE DYSENTERY SYNDROME
Philip C. Holzberger, M.D., Aruba, Netherlands West Indies

PREVENTION OF LOW BACK DISABILITY
William F. Becker, M.D., Chicago

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Journal of Occupational Medicine

Skin Grafting of Burns

Clifford L. Kiehn, M.D., and John D. DesPrez, M.D., Cleveland, Ohio

THE PHYSICIAN who engages in the treatment of a burned patient is faced with two problems: He must first meet the acute problems associated with the losses of fluids and electrolytes and the stabilization of the blood volume of the patient; he must subsequently decide how to manage the burn itself so that the patient may be returned to normal as soon as possible.

During the first 24 hours following a burn, it is sometimes difficult to determine the extent and degree of injury to the skin. It may require several days to determine the depth of the damage and the extent of the area which must be replaced with normal skin by means of split-thickness skin grafts. A well-demarcated full-thickness loss of skin in the very early period following thermal injury is usually the result of a combination of the application of pressure and heat for a sufficient period of time. Around this area there may be a gradation of injury involving less than all layers of skin.

Early Surgical Management

The patient should receive early debridement, including the removal of blebs and desiccated shreds of burned epithelium, regardless of the depth of the burn. The physician is next faced with the decision as to whether the patient should be treated with the "exposure" technique or the wound immediately covered with pressure dressings. We believe that many burns may be treated by the exposure technique—that is, without dressings—with the exception of burns involving the hands. In this latter case, massive pressure dressings should be applied immediately. The term "exposure" is used here in contrast to the term "closed," since all burns are actually treated by a closed method whether they are covered with dressings or by devitalized, desiccated tissues. The important consideration is that all burns should be treated so that the subcutaneous tissue is covered either by burned tissue or by pressure dressings. The purpose of the dressing is to prevent edema and further contamination of the wound.

The injured tissues should be treated in such a way that any devitalized tissue will be removed and replaced with skin grafts without the resultant exposure of subcutaneous tissue for a long period of time. This can be accomplished by two methods: (1) The burned tissue is excised early (which is possible when less than 25% of the body surface area is involved), with the subsequent immediate application of split-thickness skin grafts. Sometimes it is advisable to wait 24 to 48 hours after the excision of the devitalized tissues before the skin grafts are placed on the raw surfaces. (2) During a period of watchful waiting, the devitalized tissue may separate from its bed, thereby clearly defining the limits of full-thickness loss. The area will then granulate and require coverage with split skin grafts. It is our opinion that a policy of immediate excision, within the first week following the burn, and subsequent skin grafting is very limited in usefulness. It does have an advantage in that it serves as a rapid method of covering the defect with normal skin. Its primary disadvantage is due to the fact that when large surfaces involving

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Presented at the Industrial Medical Association of Pittsburgh meeting, Cleveland, Ohio, May 20, 1960.

Fig. 1—Well-demarcated burn that may be excised immediately and covered with split skin grafts.

Fig. 2—Split skin grafts applied to surface after excision of small area burn.

greater than 15% to 25% of the body surface area are excised this method of treatment has resulted in mortality rates which have been high.

If the technique of permitting the devitalized tissues to separate by themselves with daily debridement is employed, then great care must be taken to prevent further contamination of the wound and to prepare the granulation tissues so that they will receive the grafts in every instance. Debridement of the wound should be done daily after the devitalized tissue begins to separate from its bed. This can be done without anesthetic, and, if done with proper care, there should be no bleeding from such debridement. Resulting raw surfaces should be covered with fine mesh gauze which has been impregnated with Xeroform (bismuth tribromophenate), and massive pressure dressings should be applied. It must be emphasized that when dressings are used they should be done daily. This will speed up the separation of devitalized tissues and prevent the products of exudation from accumulating in the dressing. Depending upon the extent of the burned area, the patient should be ready for skin grafting from 10 to 18 days following the burn injury. This presupposes that his general nutrition and metabolic state has been restored to approximately normal.

If proper care has been taken with respect to daily change of the massive pressure dressings, the granulation tissue should have a distinct appearance. It should be smooth, bright, red, and shiny, and should have no evidence of sloughing tissue. When the granulation tissue meets these criteria, split skin grafts should be applied. In order to ensure granulation tissue which meets the above-named criteria, very fine mesh gauze should be applied next to the wound and massive pressure dressings should be superimposed. In addition, the extremities should be splinted. Failure to utilize this kind of dressing produces an edematous granulation tissue which harbors bacteria and which will result in a decrease in the percentage of grafts which take.

Types of Skin Grafts

When the degree and extent of the burn injury indicate that skin grafting should be carried out, a decision must be made regarding the best method of covering the granulating surfaces. This decision will depend upon the consideration of many factors. One of the primary determinants which govern selection of the procedure to be used is the condition of the granulation tissue. If the granulating surfaces meet the criteria of ideal granulation tissue as stated previously, then sheets of skin should be used in grafting, provided that there is sufficient skin available to cover the area. This applies particularly to areas involving joints, such as the elbow and the knee. These areas should be grafted with sheets of skin as soon as possible, regardless of the extent of the burn areas involving the rest of the body. An adequate envelope of skin over these joints is necessary to ensure normal function. In an extreme situation with massive loss of skin surface, however, strips of skin may be used around the joints. These can subsequently be replaced with sheets of split-thickness skin, if necessary.

If the surface area involved in the burn is so large that adequate skin is not available to cover the area with sheets of skin, then postage-stamp-size pieces, measuring 1 cm to 2 cm, may be applied. These provide islands of epithelium from which new epithelial tissue will proliferate, bridging the intervening granulation tissue, thereby connecting the strips or islands of

Fig. 3—Granulations of back and arms which have the criteria for the successful reception of grafts.

skin grafts. This method permits covering large areas with a maximum utilization of available skin.

Another method which we believe to be of value is that of alternating autogenous and homologous strips of skin. Homologous skin is obtained either from cadavers or from a close relative. These strips are then alternated with strips of skin taken from the patient. There should be a normal take of the patient's skin, and homologous grafts will provide a temporary cover. These latter grafts will be rejected by the host within two to four weeks. After the rejection of the skin, the areas may subsequently be covered with skin grafts from the patient. If the intervening areas between strips of epithelium by this time have become small enough, it may be unnecessary to do further skin grafting. The homologous skin will provide a covering of the wound, decreasing the further loss of serum proteins and the occurrence of secondary infections. These grafts are not usually sewed on except when large sheets of skin are used. Large sheets of homologous skin can be basted on roughly to cut down on operating time.

If the granulation tissue which is to be covered is 10 to 18 days old, it need not be removed. If the granulation tissue is older than this, however, the layer of fibrous tissue may be thick beneath the granulations. In such instances, the granulations should be removed in their entirety down to normal tissue before the grafts are applied.

If it has been decided to excise the burned areas immediately, grafts may be taken at the same time, stored in a refrigerator, and applied to the patient within 48 to 72 hours without bringing the patient back to the operating room. This reduces the time the patient is under anesthesia and allows some time for the formation of granulation tissue at the sites which are to receive the grafts.

Methods of Obtaining Skin Grafts

The donor sites should be prepared by scrubbing with pHisoHex (2,2'-methylenebis[3,4,6-trichlorophenol]), thoroughly dried, and draped for a surgical procedure. The commonest method of removing the skin is with the use of a Padgett dermatome. In order to procure a full

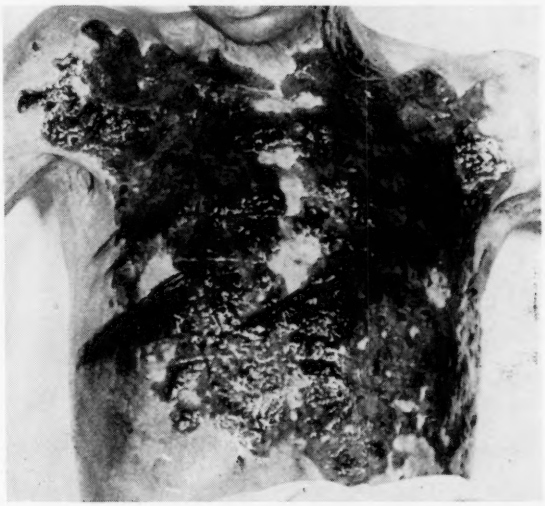

Fig. 4—Edematous old granulation tissue upon which grafts should not be placed.

Fig. 5—Grafts covering chest preventing loss of proteins and inhibiting fibrosis.

Fig. 6—Twelve-year-old circumferential burn that would not heal. Granulating tissue and very thick fibrous connective tissue removed to normal tissue for adequate nutrition to grafts.

Fig. 7—Complete take of grafts with permanent coverage of wound for the first time in 12 years.

drum of skin, a few important points should be remembered in using the dermatome. If the patient has a considerable amount of subcutaneous fat, one usually does not encounter osseous protuberances, which present technical difficulties. If these are present, a full drum of skin may be obtained by the injection of saline subcutaneously to "puff up" the donor site. Many failures to obtain a full drum of skin are blamed upon the fact that the glue either is too thin, is too thick, or has deteriorated because of aging. We feel that there are factors other than the glue which are of greater importance. One of these is the availability of a very sharp blade for use in the dermatome. A new disposable blade should be used with every drum in order to obtain the best results. This may sound wasteful, but it will produce a more uniform product without jagged edges. A dull blade will fail to cut the skin crisply within the edges of the drum, and, if tenting of the skin and subcutaneous tissues results, gouges through the entire thickness of the skin will cause full-thickness loss of skin. An additional important point is the manner of rotation of the drum at the time of taking the graft. The drum must not be rotated faster than the knife is cutting the skin. If the drum is rotated too rapidly, it will be pulled off the skin, causing a failure of the knife to contact and cut the skin surface.

We believe the following method is practically foolproof in cutting skin grafts. (1) Prepare the donor site with pHisoHex and drape properly. (2) Dry the donor site with a dry sponge. Do not use ether. (3) Use a new, sharp disposable blade, and calibrate the drum to the thickness which you desire. (4) Dry the drum with a dry sponge. Do not use ether. (5) Glue the drum with a sponge using the glue as it comes out of the container. (6) Apply glue to the donor site. Allow both layers of glue to set for four minutes before the drum is applied to the donor site. (7) Set the leading edge of the drum on this skin. Rotate the drum slightly. Bring the knife blade down to the edge of the drum, and prepare to cut the graft with long sweeping motions. The drum should be rotated at the proper speed as the skin is being cut.

No great pressure is needed to make the drum adhere to the skin. After the blade has progressed the distance of the drum, bring the blade over the wrist and reverse the drum to remove the skin from the drum. The graft is then removed with a pair of scissors or a knife. The grafts are then folded with raw surface approximated to raw surface, rolled in moist sponges, and stored until ready for use.

In preparing the drum for another graft, a dry sponge is used to clean off the drum surface. The machine is then reset with a new blade, if possible, and glue reapplied. Another four minutes is allowed for the glue to dry. The process is then repeated. All donor sites are immediately covered with Xeroform pressure dressings, making sure that the Xeroform overlaps the edges of the donor site to prevent adherence of the dry dressing to the exposed derma.

The electric dermatome is a very valuable and popular instrument which permits the rapid removal of long pieces of skin from more irregular surfaces. The big disadvantage with this instrument, however, is that one cannot obtain as wide a sheet of skin as is possible with the Padgett dermatome. The Reese dermatome is also a very popular instrument in larger medical centers. It is felt that this machine is the most accurate of any available today from the standpoint of producing grafts of uniform thickness for definitive replacement.

To obtain rapid healing of donor sites, they should be kept completely separated from grafted areas to prevent cross-contamination. Healing of these donor areas usually requires from 10 to 14 days.

Surgical Dressings Following Graftings

As early as 1943, we applied skin grafts to burned surfaces without dressings. We do not feel, however, that as good results are obtained as when grafts are covered with massive pressure dressings at the time of application. A most efficient dressing is built upon the graft by placing one layer of Xeroform gauze (which is kept dry to prevent maceration of the graft) next to the graft. Gauze is then added to this, and material which provides bulk to the dressing is layered upon the gauze. Bulkiness may be supplied by the use of cotton, mechanics' waste, foam rubber, or other materials. More gauze is then added and elastic bandages are used to prevent the grafts and dressings from slipping. A high percentage of failure of grafts to take is due to inadequate attention to dressings.

If proper attention is paid to local factors such as complete control of bleeding and of infection, then a graft should result in complete success. If the patient's hemoglobin and/or serum proteins are low at the time the grafts are applied, however, these factors will have some influence upon the fate of the graft. The dressings are left on from 48 to 72 hours and then changed in order to investigate the possibility that hematomas, seromas, or abcesses have formed under the graft.

Additional measures such as perforation of the graft in order to prevent hematomas or collection of the products of suppuration are practically useless, since it is not known where these might form. If at the time of the first dressing change no hematomas or abscesses are found, then dressings are carefully reapplied. The graft should not be disturbed for a period of one week unless there is an elevation of temperature or other indication of wound infection. If an infection occurs, dressings are changed daily to prevent loss of the graft. In two weeks' time, the graft should be completely vascularized, and if no areas of granulation are present no further dressings are needed. Physical therapy can then be instituted to return the patient to full activity as soon as possible.

(Dr. Kiehn's address is 10605 Chester Ave., Cleveland 6, Ohio.)

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Psychiatry in Industry

AS SEEN BY AN INDUSTRIAL PHYSICIAN

E. F. Buyniski, M.D., Cincinnati, Ohio

THE NEED for a psychiatrist as a consultant to an industrial medical practice is becoming more and more evident. As more industrial physicians make use of this consultant, they will learn that psychiatrists have certain limitations. The mystery of psychiatric diagnosis and treatment, as it impresses the industrial physician, may become the source of misunderstandings. On the other hand, the lack of appreciation of the industrial viewpoint by the psychiatrist may create a breach in communication between the two parties. These two factors, if not identified, tend to lower the effective utilization of the psychiatrist as a consultant to an industrial practice.

The opportunities for effective cooperative effort on the part of the psychiatrist and the industrial physician appear daily. Employees have learned to use symptoms as a means of avoiding the stresses of the job. They use headaches, upset stomachs, indigestion, and many other symptoms as justifications. As they appear in the dispensaries, a little interest on the part of the medical personnel will often reveal the "toxic" atmosphere of a job as the cause of the symptoms. What happens to the employee at this stage is largely dependent on the interest of the medical director and his staff. This paper treats the impressions of one industrial physician who has learned, through the trials of experience, how the psychiatric program can succeed.

The author became aware of this problem early in his industrial experience. Patients with obvious somatic symptoms were referred to the doctor for advice. The medical problems were relatively simple but, surprisingly enough, difficult to eradicate. The elimination of one set of symptoms was often followed by the appearance of new ones, some of which were more bizarre in nature than the original. It became obvious that there were some factors in the employee's life that perpetuated the production of these symptoms and that his appearance in the doctor's office provided some sort of an outlet. To give up the opportunity of going to see the doctor was more than the employee could do.

We were also faced with situations where the interrelationship between the supervisor and the employee was a disabling factor. In normal circumstances, supervisors exercise a great deal of latitude in placing temporarily disabled employees and generally are successful with little or no difficulty. So when a job placement problem was referred to us, the possibility of an emotional component was usually considered. When we focused our attention on the disability, we were often led astray until a more careful examination brought the emotional problem to the surface.

The following incident illustrates the point. A machinist who had had a coronary occlusion was approved to return to work after an extensive illness. A conference between the plant physician and the foreman resulted in his being placed in what appeared to be a reasonable physical classification. During this conference, the plant physician was impressed by the foreman's unusual interest in placing the employee. He was all the more surprised when the employee appeared in his office a short while later complaining of excessive fatigue. The employee ascribed the cause of his symptom to his new job, which, in the doctor's opinion, was compatible with the employee's work capacity. Another conference led to a transfer to a lighter job, still within the same work unit. He continued to complain of excessive fatigue. The foreman insisted that this was the lightest work available in the area. This meant that the patient was put on an open transfer.

The plant physician was disturbed because

Dr. Buyniski is Medical Director of the Flight Propulsion Division, General Electric Company, Evendale Plant.

Submitted for publication May 1, 1959.

his evaluation convinced him that any of the jobs to which the patient had been assigned were well within his work tolerance. The foreman was again interviewed. While giving him assurance that the employee would definitely be transferred out of his area, the plant physician noticed an expression of relief on the foreman's face. Under careful questioning, the physician detected feelings within the foreman which confirmed his original suspicion. The relationship existing between this foreman and the employee was such that the foreman experienced anxiety that was communicated to the employee, who, in turn, reacted to the situation by developing fatigue. After the employee's transfer to a new foreman, the symptom disappeared, and he made a satisfactory adjustment to the new job.

Once a physician in industry is alert to the possibility of emotional conflicts complicating what appear to be simple problems, the next step is to acquire understanding of how these problems developed. *This is where the psychiatrist can make his most valuable contribution.* In the case just cited, it would not have been necessary to have the psychiatrist see either the patient or the foreman. At the time that events were not progressing along anticipated lines, a consultation between the psychiatrist and the attending physician would have brought out the possibility of a conflict between the employee and the foreman. Aware of such a condition, the physician could guide his action in such a manner as to spare undue trauma to the patient by not permitting him to work under such stress-producing situations.

Getting Started

Custom, habits, and codes of etiquette are something few people talk about. They are the unwritten rules which all people within a factory, and in every organization, learn to observe. The industrial physician may occasionally have to learn these rules the hard way, but once learned they become a part of his daily routine. He also soon accepts company policies and practices in the same manner. Any of these rules, however, can create serious problems if the industrial physician is not constantly aware of their presence.

A psychiatrist, unless he is exposed to these "hidden rules of conduct," may experience some difficulty in interpreting employee behavior. It is almost a "must" for the psychiatrist to be well acquainted with these rules so that recommendations he may make will be consistent with existing custom. He will find that his usefulness to the plant physician will increase as he becomes acquainted with the plant routine.

After a sufficient orientation is accomplished, the psychiatrist should utilize every opportunity in his contact with the industrial physician to enlarge the latter's scope and understanding of the mechanics of human behavior. At the beginning, it will be necessary that the communication be at the simplest level possible with interpretations understandable by the industrial physician. There should be little or no discussion of unconscious mechanisms until such time as the physician in industry acquires sufficient background knowledge to assimilate it.

Psychologists and Psychiatrists

When we first began to consider the use of an in-plant psychiatric service, the author was asked whether we could not make use of the psychologists who were already employed. The difference between a psychologist's function and that of a psychiatrist was not clearly understood. Had he been aware of this uncertainty, he would have taken a different approach in the development of a psychiatric program.

The industrial psychologists* have developed specific abilities to perform definite tasks. They have already demonstrated their value to industry in the area of selection of supervisors, evaluating employee attitudes, and assessing aptitudes of employees who are not functioning at optimum levels. They are trained to place applicants in jobs where they can make the greatest contribution. In general, the industrial psychologist is very effective in dealing with groups. His opinions as to how an individual compares with members of a group have been validated. In dealing with the behavior of individuals, on the other hand, there is not so much certainty. In contrast, the psychiatrist is more secure in his dealings with individuals and less certain when faced with group responses.

Sooner or later, each industrial physician who attempts to broaden his scope in the field of human relations must integrate his personal approach with that of the industrial psychologist if he wants to achieve success in his efforts. That a psychologist and a physician can work together effectively has been demonstrated in several plants. The goal of the physician is to help the psychologist become aware of the doctor's abilities that stem from his training as a physician. He can offer his opinions on a problem when consulted. He should try to point out to the psychologist that if the latter has done a

*The psychologists may be classified as industrial, clinical, experimental, and counseling. Except for the industrial, all are found in limited numbers in industrial plants, although it is possible that all functions may be performed by the industrial psychologist.

thorough evaluation of an employee and the employee fails to come up to the anticipated performance the psychologist should not look upon this as failure on his part. The physician can help by pointing out to the psychologist the possibility of the employee's being emotionally ill. Perhaps the evaluation from a clinical point of view may uncover the reason that this particular employee failed to make the grade. Through the integration of these professions, success in this area should quickly become apparent.

Emotional First Aid

Dr. Lydia Giberson, formerly a psychiatrist with the Metropolitan Life Insurance Company, is generally credited as the originator of the term "emotional first aid." This concept, further expanded by Temple Burling[1] and Levinson and Menninger,[2] fits very nicely with existing practice of providing medical first aid in industrial dispensaries. A person suffering from an acute anxiety generally develops somatic symptoms which he can use as a justification to reach the protective atmosphere of a dispensary. Often, the anxiety results in an injury which then requires treatment. If the total personality evaluation is integrated with the management of the symptoms or injury which the patient presents, constructive measures can be taken to reduce the psychological trauma and disability of such a condition. *To do this, the dispensary personnel need training by a psychiatrist.* This does not mean that they have to be taught definitive diagnostic or therapeutic measures, but they should be trained to be aware of the psychological defense mechanisms so that their treatment does not intensify resistance or lower the defensive mechanisms.

The following case will help demonstrate the need for dispensary personnel to understand their patients.

CASE 1—A press operator was brought to the dispensary because a slug hit him in the forearm. When he was first seen in the dispensary, he showed no abnormal emotional manifestation other than being passive in his attitude. It was not known that he had a sick wife in the hospital who was undergoing her 16th operation. The injury was complicated by numerous unexpected events. The physician who first saw him felt that he needed hospitalization. Transportation was not readily available. His foreman was asked to take him to the hospital, and on the way their car was involved in an accident, and the patient suffered additional injuries of the nose, other arm, and knee. All of this contributed to the patient's feeling of rejection and loss of confidence in himself. He regressed emotionally, feeling that the company was responsible for his mutilation and that if he were compensated for this he could make a start in a new occupation. Because of a long delay in processing papers, the patient began to place a greater and greater value on his condition until one day he said, "Even a million dollars will not compensate me for the suffering I am enduring." This patient would not probably have become a permanently disabled employee had his marginal adjustment been recognized early in the treatment.

The role of a psychiatrist in the field of emotional first aid should be that of a teacher to the nurses and physicians. He should aim at improving their technical skills, capabilities, and understanding of psychological mechanisms so that they become alert to signs of impending emotional decompensation. Recognition is one phase, and then helping the patient is the other. The following case illustrates how the psychiatrist was effective in an area which would normally be considered as a serious emergency by industrial physicians.

CASE 2—A 23-year-old technician had several psychotic episodes which necessitated hospitalization. After each recovery, he returned to work. One day, he became phychotic while on the job and began to wander aimlessly around the plant. Several guards were required to hold him and to get him to an ambulance and out of the plant. The production in the building came to a standstill as the other employees witnessed the struggle between the patient and the guards. Subsequently, the psychiatrist joined the staff and, in one of the discussions, described the mechanism of psychoses and offered constructive recommendations to the medical staff on how to deal with a psychotic patient. Not too long after this, the patient had a similar episode. The situation was in accordance with the earlier advice of the psychiatrist, and within half an hour the patient calmly left the plant with no disurbance to production.

Emotional Toxicology

Industrial hygiene is an accepted adjunct to an industrial health program. Hazardous environment is detected and brought under control very early. But more attention can be paid to an environmental hazard in the form of the emotional pressure exerted on employees by their supervisors. The effects of inconsiderate supervisors or hostile fellow workers on plant population are readily observable at plant dispensaries. Although it is true that home situations have an impact on the etiology of these conditions, more effort can be made to apply accepted industrial hygiene principles in detoxifying these emotional "toxins."

The detection of these harmful influences on work groups is a fertile field. How many gastric ulcers can such environments produce in a given work area? How many days are lost because of migraine and other psychosomatic illnesses caused by such conditions? All this is going on

under our noses while we are concerning ourselves with the possibility of benzol poisoning and other chemical intoxications. The psychiatrist is capable of performing the same function in the area of emotional toxicology as the industrial hygienist in the physical area.

Education

Psychiatry is not accepted readily by employees. Too many persons still identify its practice with insanity. It will take careful planning and work on the part of the industrial physician to prepare the plant for the psychiatrist's acceptance. He must first dispel his own prejudices by learning first hand what psychiatry, as a specialty, attempts to accomplish. Then, he is ready to start on a constructive mental health program.

At this point, the psychiatrist should take over. He must plan his work judiciously so as not to stir up unjust prejudices in the employees. Just as the industrial nurse acquires plant acceptance by giving comfort to sick patients, so can the psychiatrist through his success in making patients feel better. Once accepted, he can then put into use all the abilities and skills his training provides.

Conducting informal as well as formal training classes for physicians and nurses completes the psychiatrist's responsibility in the field of education. If he is interested, there is a fertile field among the supervisors. He may plan to meet with these groups informally at social functions and stimulate an interest among them in the principles of good mental health.

Group Therapy

There are not enough skilled personnel within industry to provide help to those individuals who need and ask for it. Person-to-person relationship therapy is not economical. Its effects are diluted in the plant, and it would take a lifetime for the company to become significantly aware of the psychiatrist's activity. The use of the group approach offers a solution to the problem. It can take the form of workshops for executives and other key people, as described by Laughlin.[3] Or it can be introduced in the form of an information meeting with foremen and general foremen. Under these conditions, the psychiatrist can reinforce statements made by members of the group which are significant and pertinent to the understanding of fundamental psychiatric percepts.

Executive Counseling

The executives are an important element in the structure of a business organization. Many important decisions affecting large segments of the plant population are made by these individuals, and it becomes vital to the organization that these decisions be made wisely. When wrong decisions are rendered, they can usually be traced to misinterpretation of facts through personal prejudice.

Family problems have an important bearing on the manner in which executives behave. Unfortunately, they have no one to turn to for counsel. Fellow executives might misinterpret their unburdening as a sign of weakness. Those under them would not understand the motive. Having a psychiatrist who understands the dynamics of the organization as well as of the individual could prove beneficial in helping the executives render more substantial decisions.

Preventive Counseling

Industrial medicine has been built on the concept of prevention. Being a part of an industrial health program, the psychiatrist should orient his activity along preventive lines. He can, for instance, play an integral part in the periodic health examinations conducted by the plant physician. Not only can he offer immediate help in the form of counseling on job-connected problems, but he can anticipate and plan for future complications. At the same time, he can reduce the resistance to the concept of psychiatry and motivate the employee to seek out his help in cases of emotional stress.

How to Choose the Right Man

In general terms, psychiatrists can be classified into two major categories: those who are analytically oriented and those who are not. The former believe that the interaction of the patient with his environment can be modified by understanding and correcting certain inadequate methods of facing life's stresses. The other group regard the patient's behavior as a result of certain fundamental chemical reactions that are not functioning properly. Treatment then becomes a matter of reestablishing these chemical reactions along normal lines. The introduction of tranquilizers and their excellent results in the treatment of psychotics point out that body chemistry may play a part in determining human behavior. The future of psychiatry may be in the integration of these two schools, where drugs will be used to sedate the disturbed patients in order to make them more readily accessible to interpretative or supportive psychotherapy.

The psychiatrists are further classified according to their philosophical approach to industry's problems. One group tend to identify themselves with nonmedical people, feeling that they can make the greatest contribution to the

personnel department. The other consider themselves primarily physicians and find it more effective to work out of the medical department in a clinical atmosphere. In either case the psychiatrist can make a valuable contribution to the improvement of the emotional climate of the plant.

Establishment of an In-Plant Psychiatric Program

Very few plants are large enough to afford the services of a full-time psychiatrist. There are only a few psychiatrists who are sufficiently equipped or interested in industry's problems to give up their routine practice. It then should be the industrial physician's responsibility to explore the available community services and make the selection of a psychiatrist based on his individual needs.

It is extremely difficult for a practicing psychiatrist to appreciate the detailed workings and problems within an industrial community. He has been accustomed to dealing with patients in a clinical atmosphere and will automatically apply the same philosophy in his work within the plant. The medical director should be aware of this tendency and offer guidance so that the psychiatrist's time can be most profitably utilized. He should be patient and allow ample time for the psychiatrist to acquaint himself with company policies and procedures.

After the period of orientation is completed, the psychiatrist should prepare long range objectives which can be used by members of the medical department as a guide in their psychiatric orientation. These can also be useful in orienting the personnel and other auxiliary services in what to expect from the psychiatrist.

When the plant community has accepted the in-plant psychiatric program without too much reservation, patients can be referred directly to the psychiatrist for first aid and other services. The psychiatrist should now become acquainted with the dynamics and the political atmosphere of various groups. He should be alerted to trouble areas and offer his services to help correct them long before they become serious and disturbing to the plant.

Administrative problems such as record keeping, appointments, and confidentiality of information should be clarified early in the psychiatric program. There should be clear-cut understanding between the psychiatrist and the professional people in the medical group as to how cases are to be handled and information communicated within as well as outside of the medical atmosphere.

Needless to say, the personality of the psychiatrist is very important. The first impression he creates in the plant will often determine the acceptance or failure of the program.

Summary

There is no question that there is a need for a psychiatric service in industry. The psychiatrist must integrate with the plant community to better understand the needs of the group. He must provide the skills of his profession in such a manner as to make them easily acceptable by the individuals. Once established, he then can concentrate on a variety of programs ranging from groups to individuals, providing the services he thinks the industrial community needs.

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2. Levinson, H., and Menninger, W.: The Machine That Made Pop an Industrial Fable, *Menninger Quart.* (Summer) 1954.

3. Laughlin, H.: An Approach to Executive Development, *Dis. Nerv. System* 15:12, 1954.

Correction

In the article "Occupational Physical Exertion and Coronary Atherosclerotic Heart Disease" by David M. Spain, M.D., which appeared in the February, 1961, issue of this journal (pages 54-58), a typographical error occurred in Table VI. The total number of cases of atherosclerotic occlusion shown in the table should have been 277 instead of 27.

Application of Workmen's Compensation Laws to Radiation Injuries

John K. Dane, Boston, Mass.

THERE ARE fifty-four workmen's compensation acts in the United States today which govern the rights of workers injured or disabled in employment. These include the workmen's compensation acts of the 50 states, Puerto Rico, the District of Columbia, the Federal Employees Compensation Act, and the Long-shoremen's and Harbor Workers' Compensation Act. These acts, of course, vary in their individual provisions in accordance with local needs, but there is a considerable similarilty in basic objectives.

In general, these compensation acts cover personal injury by accident arising out of and in the course of employment, including such disease as results from such injury, and all but two of them cover, under various definitions, occupational disease which results from exposure to conditions causing the disease in employment.

General Problem

The underlying objective of workmen's compensation was to substitute for the long-drawn-out, expensive, and uncertain common law negligence action of workmen injured in employment against their employer an obligation on the employer, regardless of his fault, to provide weekly indemnity for loss of wages in the event of disability and medical treatment and hospitalization to relieve or cure the effects of injury.

The compensation system as we know it today did not, of course, spring into being at once or without difficulty, nor has it reached its present state without constant questioning, revision, and improvement. From the first workmen's compensation act, in 1911, to the last, in 1948, there have been problems which required thoughtful attention of informed people. Such a problem exists today in the exposure of workmen to the hazards of injury and disease resulting from radiation.

The problem of determining the application of workmen's compensation acts to radiation injuries is complicated to some degree by the fact that the ways in which radiation causes injury in the human body are not fully understood. Basically, it seems that radiation damages the cells forming a part of the body and that this damage varies with the severity and duration of the exposure as well as with the amount of the body exposed. If we accept the classification suggested by one authority, we may divide radiation injury into three broad classes: (1) obvious and fairly prompt damage to the exposed workman often followed by some degree of delayed injury; (2) delayed damage to the exposed workman; (3) damage to offspring of the exposed workman. In addition, it appears that effects of exposure to radiation are cumulative, so that individual exposures, not harmful in themselves, may through repetition cause injury.

Exposure Causing Accidental Injury

With these points in mind, let us consider the application of workmen's compensation acts to radiation injuries. Where a worker is exposed to excessive amounts of radiation in his employment resulting in obvious and fairly prompt injury, as in the case of severe radiation burns, such injury will be compensable under every workmen's compensation act as an injujry by accident. Furthermore, any delayed injury and all disease which results from such an exposure will also be compensable. Most of the injuries which have occurred to date in incidents involving exposure of workers in facilities operated by the United States Atomic Energy Commission have fallen in this class and would have been compensable as injuries by accident.[1]

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In my own company we have kept a record of cases involving exposure of policyholder employees to radiation. In most of these cases exposure has been small and there has been no disability to date and no present indication of injury. Nine cases involved actual injury. Three of these were compensable as an injury by accident.

Exposure Causing Occupational Disease

Where a worker sustains injury or disease through the cumulative effect of continuous or repeated exposure to small amounts of radiation, there are problems involved in the application of these workmen's compensation acts to such injury. Such exposures may result in radiodermatitis or even lesions of the skin leading to cancers. Cases like these do not fit well, if at all, into the concept of an accident, which is by definition a sudden or unexpected event which takes place fortuitously and without expectation or foresight. Therefore, if such injury or disease is to be compensable, it must be as an occupational disease or by other specific provision in the applicable workmen's compensation act.

There are today only three states whose workmen's compensation acts do not make any provision for occupational disease resulting from exposure to radiation. These states are Alabama, Mississippi, and Wyoming. The workmen's compensation acts of all other jurisdictions provide at least some protection against occupational disease due to radiation. The California Workmen's Compensation Act illustrates the broadest form of coverage for such diseases. In that act, the word "injury" is defined to include "any injury or disease arising out of the employment. . . ."[2]

Under this definition, disease caused by exposure to radiation will be compensable whether it occurs immediately, or after continuous and repeated exposure, or after a long latent period.

The qualification expressed in this definition that injury, to be compensable, must "arise out of employment" is important in cases involving radiation injury, inasmuch as radiation is by no means an exclusive agent with respect to some of the diseases which it may cause. In general, for injury to arise out of employment there must be something in the employment which causes a greater risk of harm to the employee than he would be exposed to as a member of the public in general. Commenting on the proof required in disease cases in ruling on the claim of a worker who had contracted conjunctivitis, the California Supreme Court said[3]:

> It must be shown that the disease contracted was not merely a hazard of the community but that the employee was exposed to some special exposure in excess of that of the commonality. . . . The employee's risk of contracting the disease by virtue of the employment must be materially greater than that of the general public; i.e., the injury must be a natural or a reasonably probable result of the employment or of the conditions thereof.

Much the same idea is expressed in explicit language in connection with the definition of occupational disease contained in a number of state acts. Thus the workmen's compensation act of Kansas specifies[4] that an occupational disease to be compensable must result from the nature of the employment, "meaning by 'nature of the employment' that to the occupation in which the employee or workman was engaged there is attached a particular hazard of such disease that distinguishes it from the usual run of occupations and is in excess of the hazard of such disease attending employment in general. . . ." Inasmuch as some of the diseases caused by exposure to radiation may develop from other known causes or even spontaneously, qualifications such as these would appear desirable as serving to limit compensability to those cases which should properly be a charge upon industry.

There are 30 states in which complete coverage is afforded under a general definition for all occupational disease due to radiation. In addition complete coverage is afforded under the Workmen's Compensation Act of Puerto Rico and all the federal acts.*

Of the remaining states, 17 have statutory provisions which afford some coverage for disease due to continuous or repeated exposure to radiation. In these states coverage is afforded for specified occupational diseases listed in a schedule. A common provision in this type of compensation act reads: "diseased condition caused by exposure to x-rays or radioactive substances." Such a provision would undoubtedly comprehend most industrial exposures which are common today. However, it seems there is some question whether diseases suffered as the result of exposure to radiation from particle accelerators would be covered. While the number of exposures from this source is undoubtedly not high, the fact remains that they do occur. In my own company we now have two such cases. Other

* These states are Alaska, California, Connecticut, Delaware, Florida, Hawaii, Illinios, Indiana, Kentucky, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, Nevada, New Jersey, New York, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Utah, Virginia, Washington, West Virginia, and Wisconsin.

interesting questions have been raised, especially as to whether exposure to "radioactive substances" would include exposure to neutron beams emanating from nuclear reactors, which are more strictly radiations from "fissionable substances," or whether exposure to radioactive substances includes the taking of such substances internally.[5]

Because of the acknowledged difficulty with the incompleteness of such provisions, a number of these states have amended their schedules to apply to conditions caused by "exposure to ionizing radiation." This language, by characterizing the nature of the radiation rather than its source, clearly overcomes any question as to coverage for cyclotron workers.[6]

Repeated Exposure Cases as Accidental Injury

Although the workmen's compensation acts of Alabama, Mississippi, and Wyoming apply only to injury by accident and do not make any specific provision for compensation of disease due to exposure to radiation, it should not necessarily by supposed that such cases will never be compensable in these states. The word "injury" as used in workmen's compensation acts probably is sufficiently broad to include the contracting of disease. The difficulty in finding occupational disease compensable unless expressly covered has usually centered about the interpretation of the requirement that injury be accidental. In cases where disease develops imperceptibly over a period of time, there is no single unexpected or untoward event which may be pointed to as the accident. Accordingly, under many workmen's compensation acts prior to the passage of specific provisions making occupational disease compensable, such cases were denied benefits.

The Mississippi Supreme Court has held that contraction of an allergy was an accidental injury and that contact dermatitis caused by exposure to soap in the course of work as a dishwasher was an accidental injury. In each case the court said "under our compensation law it is not necessary that an accidental injury as therein defined must result suddenly nor is it necessary that it result from the application of external force."[7]

Similarly the Wyoming Supreme Court has held that silicosis contracted as a result of six weeks' exposure to dust in connection with an employee's duties tending a rock crusher was compensable as an accidental injury. The court said:

> Whether the abnormal condition produced in claimant's lungs in consequence of his inhalation of particles of rock dust be regarded as a disease or as a mechanical hurt, growing progressively worse, on account of the sharp particles retained in the lungs, for disease and injury sometimes overlap as the courts have pointed out, in our opinion, without the design or expectation of any one, it 'directly' resulted 'from an injury incurred in the employment,' as contemplated by our state statute.[8]

In a later case contact dermatitis suffered by a nurse's aide because of exposure to medicines used in the treatment of children in the dispensary of the Wyoming State Training School was held to be compensable as an accidental injury.[9]

On the basis of these decisions it would appear that most cases of dermatitis or of disease induced by exposure to small amounts of radiation over a period of time would be compensable under the workmen's compensation acts of these states as an accidental injury.

Time Limitations on Compensability

Where exposure to radiation results in delayed damage to the exposed workman, there may be a latent period of several years. In the case of some malignancies, for example, it has been estimated that the disease may not emerge for as long as 20 to 25 years.[10] Such cases present difficult problems as to the application of workmen's compensation acts.

Many workmen's compensation acts require that disablement or death to be compensable must occur within a limited time after the last exposure to the condition causing the disease or after termination of employment with the employer against whom claim is made. Where these time limitations exist, even though a disease occurring after exposure to radiation would otherwise be compensable, the worker's compensation claim will be forever barred if his disease does not manifest itself until after the limited period has expired.

There are 30 state workmen's compensation acts which contain such limiting periods applicable to radiation injury. The provisions of each of these workmen's compensation acts vary widely, and it is necessary in each case to consult the specific language of the applicable law to determine the precise effect of the limitation. The time limitations contained in these workmen's compensation acts present a considerable range. In Colorado disablement must result within 120 days from the date of the last injurious exposure while actually working for the employer against whom claim is made. In Wisconsin claim may be brought only within six years after the date of last employment with the responsible employer. In the remaining states the most usual limitation period is one year, but two states allow two years, three

allow three years and one, New Jersey, allows five years. Special provisions are usually applicable to death resulting from such injury which follows a period of total and continuous disability. In such cases the limitation period is usually longer and in many cases as long as seven years.

In addition to these time limitations which are actually conditions of compensability, all workmen's compensation acts contain statutes of limitations which require a person who has been injured or disabled to make claim within a stated period or it will be barred. In many, and perhaps in most, cases of radiation injury, this kind of limitation will not be a problem. Certainly when there has been severe exposure to radiation resulting in visible injury and disablement the relation of the injury to employment will be readily apparent and claim should be promptly made. Equally in cases of dermatitis or ulceration or tumors caused by repeated or continuous exposure up to or very nearly up to the date of injury there will be no problem. However, in those probably rare cases where disease follows a long latent period after exposure there may be difficulty because the relationship of the disease to the exposure at work, and hence its compensability, may not readily be apparent.

The statutory periods allowed by workmen's compensation laws run from as short a period as 60 days in the case of North Dakota to as long as 6 years in the case of Minnesota. But the important point in this respect is not so much the length of the period allowed as the date on which it begins to run.

In most of these states the statute of limitations begins to run either from the date of disablement or from the date of injury. In either case, however, a worker suffering from disease may not be able to make a claim for compensation benefits in time unless he understands the nature of his disease and its connection with his employment. In recognition of this fact, a number of states have expressly provided or the courts have so construed statutory provisions that this kind of limitation begins to run from the date the employee either knew or in the exercise of reasonable diligence should have known that he was suffering from disease and is aware that it was caused by his employment.

A number of workmen's compensation acts require that when compensation benefits have been paid because of disability, a further claim for disability due to the same injury must be made within a limited time from the date compensation was last paid. Persons who are exposed to excessive amounts of radiation frequently suffer a period of acute illness, after which they recover and enjoy a long period of apparent health before there is further evidence of injury. Because of the unusual nature of radiation injury in this respect, it seems doubtful that such provisions should be applicable to these cases. Should delayed effects cause subsequent disability resulting from the original exposure, compensation should be payable.

Adequacy of Medical Benefits

As we have already stated, the objectives of a workmen's compensation act are to provide weekly benefits to replace lost wages and to provide medical attention to restore the injured workman to productive labor. The question of weekly indemnity as such is not of particular significance in connection with radiation injury, since there is no reason for the amount of wage loss replacement to depend upon the manner in which injury is sustained.

On the other hand, radiation injury, and especially some of the diseases which may be caused by exposure to radiation, will probably require extended periods of medical attention and long hospitalization. For this reason it is important to consider the provisions of these workmen's compensation acts as to medical benefits. The workmen's compensation acts of 34 states, Puerto Rico, the District of Columbia, and the Federal Employees Workmen's Compensation Act and United States Longshoremen's and Harbor Workers' Compensation Act provide full medical coverage for radiation injuries. The remaining states in which radiation injuries are compensable provide limited medical benefits. These states limit either the time during which medical benefits are payable or the total amount payable. Five of these states apply both limitations. The smallest benefit payable is $1,000 in the case of Arizona and South Dakota. The largest benefit payable is $5,000 in the case of Vermont. The shortest period during which medical benefits are payable is 60 days in the case of Virginia and the longest period is 1 year in the case of Tennessee. In several of the states in this group there are statutory provisions under which the agency which administers the law may allow medical benefits either for a longer period of time or in a somewhat larger amount. However, it is clear that any such limitations in radiation injury cases may well result in serious lack of necessary medical attention for injured workmen. As a matter of interest it may be noted here that workmen's compensation insurers generally make available supplemental medical coverage which may be purchased by employers for a small additional premium. This insurance

provides voluntary medical payments up to $10,000 for each employee in excess of the amount provided by law, and even greater limits may be purchased if desired.

Proximate Cause and Proof of Exposure

The nature of ionizing radiation is different from that of most other hazards in industry today in that it cannot be detected by the unaided human senses. This fact, together with the long latent period of some injuries caused by radiation, creates one of the most difficult problems which must be met in determining the application of a workmen's compensation act to such injury. The problem is that of establishing proof of exposure in employment to sufficient radiation to cause the disease, and proof that the disease was in fact due to such exposure. Unfortunately, the diseases which may result from exposure to radiation are not of a kind which can be medically stated as resulting exclusively from such exposure. There are a number of materials in wide use in industry today which can cause these diseases, and it is just as clear that there are a number of nonoccupational exposures which can cause or contribute to the onset of these diseases.

First, it is clear that the basis of any sensible effort to establish proof of exposure must be a continuous and well-kept record of the exposure of every employee to radiation sources. The Atomic Energy Commission Safety Regulations prescribed personnel monitoring and records to be kept for persons exposed to radiation. These regulations apply to employers using radioactive material under license from the Commission. There are, of course, a number of radiation sources not licensed by the Commission. As to these, a number of states have adopted legislation based on the model regulations proposed by the National Committee on Radiation Protection.[11]

Sections 8 and 9 of these regulations require personnel monitoring and radiation surveys and prescribe radiation records that must be kept. These records, if properly kept and preserved, will go a long way toward providing the necessary evidence upon which proof of exposure must be based.

Second, physicians and especially industrial physicians will be called upon to assist in solving the problems of causation in radiation cases. The industrial physician especially is in a position to make a unique contribution. In connection with the over-all problem, his experience in industrial exposures should provide assistance in the determination of policy under and administration of workmen's compensation acts. In addition, the data which he collects will, as time goes on, provide a basis for improved standards of control and a more precise understanding of the relationship between exposure and injury.

In connection with individual claims, the industrial physician will be called upon to provide expert testimony to assist in solving the complex problems which these radiation claims present. Furthermore, the data which he collects and the medical records which he keeps of exposures in individual cases will provide a sound basis for medical evaluation.

Actions Still Needed

This discussion of the application of workmen's compensation acts indicates that while there is substantial coverage for radiation injury in many states, there are a number of problems to be met if full and complete protection is to be afforded to workmen exposed to radiation hazards. These problem areas include lack of protection for disease in a few states, incomplete protection under schedule type occupational disease acts, time limitations on the compensability of injury and disease, and inadequate medical benefits. On the ground that the problems are immediate and states cannot or will not act in time, a federal system of compensation has been suggested. If the present state system is to be preserved, therefore, the states must act to meet the needs. There is every reason to believe that they can and will. Much has been done to study and publicize these problems including hearings before Congress in which all interested parties have been afforded an opportunity to be heard. As a result, administrators of workmen's compensation acts and state legislatures are fully informed. Action is being taken. For example, last year the legislatures of Iowa, Maine, Montana, and New Hampshire added coverage for occupational disease due to exposure to radiation to their workmen's compensation acts.

The use of radioactive material in industry is increasing rapidly. In a recent special report released by the Atomic Energy Commission it was estimated that the number of groups licensed by the Commission to use isotopes at the end of 1959 represented a 26% increase over the year 1958 and a 62% increase over the year 1957. The report indicates that the present number of isotope users represents only a fraction of the total potential number. With increases in the use of nuclear materials, more and more workers will be exposed to the possibility of injury from radiation hazards. Each of these workers must look to the provisions of his state workmen's compensation act in the event of injury. It is important, therefore, for

all persons concerned with industrial injury and disease to understand the objectives of these workmen's compensation acts and the problems which exist in their application to radiation injury and disease so that these problems can be resolved and complete protection afforded to workmen exposed to radiation.

(The author's address is Liberty Mutual Insurance Co., 175 Berkeley St., Boston, Mass.)

References

1. For a report of the incidents in which these injuries occurred see Selected Materials on Employee Radiation Hazards and Compensation, Part X.

2. California Workmen's Compensation Law, Section 3208.

3. Bethlehem Steel Company, v. Industrial Accident Commission, 135 P 2d 153, 154 (Supreme Court of California, 1943).

4. General Statutes of Kansas, 1949. Chapter 44 Article 5a, Section 44-5a01, as added by Chapter 246. Laws of 1953.

5. For a discussion of these problems see Note, 58 Michigan Law Review 302.

6. For example the New York Workmen's Compensation Act was amended in 1957 so as to apply to "Radium poisoning or disability due to radioactive properties of substances or to Roentgen rays (X-rays) *or exposure to ionizing radiation.* Section 3 (2) par. 20" (italics indicate amendment).

7. Hardin's Bakeries, Inc. *v.* Ranager, 64 So. 2d 705 (Mississippi Supreme Court, 1953); Christopher v. City Grill, 67 So. 2d 694 (Mississippi Supreme Court, 1953).

8. *In Re* Pero, 52 P 2d 211 (Supreme Court of Wyoming, 1935).

9. Wright *v.* Wyoming State Training School, 255 P 2d 211 (Supreme Court of Wyoming 1953).

10. See for example the Statement of Dr. Irving Tabershaw contained in Employee Radiation Hazards and Workmen's Compensation—Hearings Before the Sub-committee on Research and Development of the Joint Committee on Atomic Energy, Congress of the United States, 86th Congress, p. 410.

11. National Bureau of Standards Handbook No. 61, available from Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

THE DIVISION OF OCCUPATIONAL HEALTH
U.S. PUBLIC HEALTH SERVICE

announces two-week courses on

INDUSTRIAL HYGIENE ENGINEERING AND INDUSTRIAL HYGIENE CHEMISTRY
Cincinnati, Ohio—Beginning June 5

The courses will be conducted at the Occupational Health Research and Training Facility, 1014 Broadway, Cincinnati, Ohio. They will be followed by one-week courses on dust evaluation techniques and the analysis of silica, to be held concurrently from June 19 through 23.

Attendance in each course is limited to 12 engineers and 12 chemists. In the event that the courses are over-subscribed, applicants that could not be accepted will be given preference for the repeat courses for Industrial Hygiene Engineers and Industrial Hygiene Chemists during the two-week period beginning October 9, 1961. Specialized courses will follow these sessions. Details will be included in the training program bulletin available from the Facility.

Applicants will receive a copy of the training manual and other literature pertaining to the course. No tuition is charged. Travel and living expenses must be borne by the student or his employer. Applications should be addressed to the above Facility, Attention: Chief, Training Operations Section.

Functions and Aims of the United Wire, Metal and Machine Medical Center

Bernard Rothbard, M.D., New York, N.Y.

IN OCTOBER, 1954, the Board of Trustees of the United Wire, Metal, and Machine Health and Welfare Fund voted to establish a Medical Center for its members. The Center functions purely as a diagnostic and preventive medical center for union members, and their wives and children. It also participates in various community health programs.

The $100,000-$150,000 necessary to create the Medical Center was financed by a Health and Welfare Fund governed by a Board of Trustees consisting of three members from management, three members from labor, and an impartial Chairman of the Board. The money for the entire Health and Welfare program is contributed by management. This is based on a certain percentage of yearly gross payroll, depending upon the individual union-management collective bargaining agreement. The budget for the Medical Center is put into a separate account by the Welfare Fund. The excess, if any, remains in the account of the Medical Center.

The medical and administrative services of the Center are under the direction of the medical director. He formulates the medical policy, appoints all physicians to the staff, and is responsible for the operation of the Center. A Medical Advisory Board of nine physicians, appointed by the medical director, functions in an advisory capacity.

There are 19 physicians on the medical staff, covering the various specialties. All of the physicians are either board certified or board eligible. At least three quarters of these men are associated with teaching institutions. There are also one registered nurse, one practical nurse, one x-ray technician, one receptionist, and a maintenance man.

The Medical Center quarters are completely air-conditioned and occupy half (4,000 square feet) of the second floor of a six-story building located in the business district of New York City. The other half is occupied by the union officies and union meeting hall. The floor space is divided as follows: an office for the medical director, a staff room, five examining rooms, two fairly large reception rooms, a laboratory, an x-ray room with complete facilities, two separate dressing rooms for x-ray, a stock room, a filing department, and three lavatories.

On Dec. 19, 1955 the center was opened for its members, totaling about 7,500. These are employed in 200 contributing plants, ranging from a two-man plant to a plant with 1,000 persons. Since the wives and dependent children up to their 19th birthdays, are also covered, the over-all number of persons eligible is at least 25,000.

No fee is charged for any of the procedures provided at the Center to a worker or his eligible dependents. The average wage of the member is about $3,400 per year, and the average family consists of 4.4 persons. More than 40% of these people are of foreign extraction, and half of them are unable to speak or read English. This industrial field is also characterized by a large proportion of transient workers.

Health Service Promotion

Various methods are employed to educate the member to use this Center:

1. Our monthly newspaper has a section devoted entirely to the Medical Center. In it we explain what has been done and what can be done for the patient. There are articles written in Spanish to reach those who do not speak or read English.

2. Shop groups are scheduled for health screening procedures by the nurse in charge through a member in the plant (shop steward) or through a union representative. The shop steward is called on the phone and a date and hour are set aside for groups of 25 to 50 persons. The screening routine for such a session

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includes (a) chest roentgenogram; (b) urinalysis; (c) certain hematologic procedures—complete blood count, sedimentation rate, serology, blood typing, and rh test; (d) blood sugar determination. The group session introduces the individual to the center and gives us a chance to schedule a complete examination. By telling him the advantages of the complete examination we hope to overcome his fear of the "medical man."

3. Bus transporation is provided to and from the center to encourage workers to come "en masse." This brings the workers to us without any effort on their part. It has been a great factor in our success.

4. All group examinations and routine physical examinations are scheduled after working hours so that members will not suffer any financial loss. We try to have the nonworking members of the family come in at hours that will not conflict with the worker's schedule.

5. Post cards are sent to the shop and/or to the individual as a reminder for his yearly repeat physicial examination.

Complete Health Examinations

All complete examinations are by appointment only. When a person comes in for his examination, a complete history is taken and a complete physicial examination is given. All the procedures of the group screening routine are included, plus an electrocardiogram for all persons 45 years or older. If there are any suspicion-arousing findings, an appointment is made with a specific consultant. Whatever work-up the consultant feels the patient needs is readily performed. When all of the findings are in, the patient comes to the center and his condition is explained. He is told what would be the best approach to his problem if any exists. If there is nothing wrong, he is also notified to that effect.

The Family Physician

The findings are strictly confidential between the center doctor and the patient. Information is given out otherwise only to the family physician of the involved patient, and the patient is sent directly to his physician for the treatment of the condition. Thus, the family physician plays an important part in our program.

During 1956 we had 2,800 total visits with 107 requests for service from the family physician. All requests were fulfilled and reports sent to the doctor. In 1957, out of a total number of 2,386 visits, 393 were in response to family physicians' request. In 1959 we had 5,156 visits, and 481 family physicians' requests were fulfilled. There is definitely an increasing cooperation between the patient, the private physician, and our medical center.

The Employer

Preemployment examinations have also been instituted. They help the employer to weed out physically disabled people before they are accepted for a job, or it aids greatly in job placement. It also protects the Welfare Fund from a burden of costs due to preexisting conditions (we are self-insured).

Another means by which we attempt to help both union and management is in the examination of employees who are declared unfit by the employer or by the company physician after an illness. Such a person is called in and is examined by one of our consultants. If there is disagreement between the company's findings and our own, we attempt to settle the disagreement with the company physician or employer, finding the worker another job if necessary.

Hospitals

In 1959 our Medical Center made an agreement with three major hospitals for the care of those employees or members of their families who need hospitalization. The chief of staff is notified of referrals, and he may either take the cases himself or assign them to his staff members. Each patient is treated as a private case and does not become a ward patient. The Welfare Fund pays the entire hospital bill (31 days) and medical fee. This plan has been in operation for the past 18 months and has met with remarkable success.

Summary

The United Wire, Metal and Machine Health and Welfare Fund has since 1955 operated a Medical Center at the Union's headquarters in New York City. The Center carries on a health promotion program among union members and their dependents. Health screening procedures are provided to groups, at which time complete examinations (including specialists' services) are offered. Those persons found to require ambulatory care are referred to their own physicians at their own expense. Patient care in any one of three approved hospitals is completely paid for by the Center. Preemployment examinations for the industry are provided at the Center, as well as examinations related to subsequent placement problems of employees. The entire program is financed by assessments against the industry as determined in collective bargaining agreements.

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A Health Hazard Associated with Epoxy Resin-Concrete Dust

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A CONSIDERABLE amount of literature has been amassing in the past few years concerning the health hazards associated with the ever-growing use of epoxy resins in industrial applications. Most of this work concerns itself with the cutaneous effects resulting from exposure during the mixing and application of these resins. It has been generally stated that the polymerized "hardened" resin has little or no physiological activity upon the skin or mucous membranes. It has been suggested in Great Britain, however, that tooling operations on hardened resin will give rise to decomposition products which are irritating to skin and mucous membranes. The nature of these decomposition products is not fully understood but is thought to include depolymerized resin, free amines, and other intermediates.[1]

Epoxy resin-concrete is a general name applied to commercial mixtures of epoxy resin and concrete aggregate. These mixtures are currently available for use in grouting where high strength, imperviousness to oils, and chemical resistance are desired. They are used widely in anchoring machinery such as compressors under extreme vibration, impact, and temperature stresses. Epoxy concretes are typically composed of (1) epoxy resin, usually carried in a liquid vehicle, (2) hardener or catalyst, and (3) aggregate. The liquid carrying the resin is mixed with the hardener, and the aggregate is then added and mixed until thoroughly wet. The material is handled with a technique similar to that used in ordinary concrete pouring. In the particular job under study, the epoxy resin was carried in xylene. The hardener used in this instance was a mixture of two primary aliphatic amines, triethylenetetramine and dimethylaminopropylamine. The resin was "cold cured." Excellent descriptions of the chemical structures and reactions involved are contained in Bourne's article[1] and will not be repeated here.

The tenacious durability which makes this material so suitable for heavy-duty service also makes it difficult to remove when a regrouting is in order.

Job Exposure

A job involving the destructive removal of epoxy resin-concrete was undertaken on March 31, 1959. A crew of eight laborers was assigned to the job. Four of the men used air impact hammers while the other four played a small stream of water over the area of hammer contact. This water stream was found to be necessary to minimize the escape of dust formed during the hammering. The epoxy resin-concrete being removed had been poured approximately 18 months previously. Locally, this removal is accomplished by the use of air impact hammers of the type commonly known as "rivet busters," which are fitted with a pointed bit. These hammers were used to break the epoxy resin-concrete into small pieces preparatory to removal. This use extended over a five-day period.

During the first four days of the operation, six laborers developed symptoms of an upper respiratory illness and reported to the medical division for treatment. They complained of headache, sore throat, and dry cough. The job was inspected by the plant medical director on the fourth day of work. An odor resembling that of xylene was noted in the immediate atmosphere. No forced ventilation was being used. The building had large, open windows along both sides, but little air movement was present at the job site because of low outside air velocity and partial blockage afforded by other pieces of equipment in the vicinity of the work site. During observation of the work, a faint, barely visible, fumelike emanation evolved from the area where the air-hammer

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bit was penetrating the epoxy resin-concrete. This emanation was so faint that it was impossible at the time to decide whether it was a true fume or simply an extremely fine air-borne dust. Whichever it may have been, it penetrated the light curtain of water being played on the area of hammer contact. While the men were working, their faces were sometimes within 12 to 18 inches of the area of origin. The men wore safety glasses but no form of respiratory protection.

Case Histories

This report presents six cases of illness characterized by upper respiratory irritation and abnormal urinary findings occurring in workmen who were engaged in the destructive removal of epoxy resin-concrete. Because all six cases followed approximately the same clinical course, only one history has been selected for presentation:

CASE EXAMPLE—This was a 32-year-old laborer with a past history of recurrent sinusitis and frequent upper respiratory illnesses. He reported to the Medical Division after having worked on the job for two days. His chief complaint was temporal and frontal headache associated with a "sore throat." Examination revealed generalized reddening of the pharyngeal mucous membranes. The chest was clear to auscultation. His temperature was 99.6° F. Initial treatment was symptomatic, but the patient returned later that day with increasing throat discomfort and headache, at which time he was started on erythromycin, 250 mg every six hours for three days. During this treatment period, the patient continued to complain of headache and sore throat and developed a non-productive dry cough. An x-ray film was made of his chest five days after the initial visit and read as negative. Shortly afterward, all symptoms cleared and the patient has since remained well.

Urine Studies—Urinalysis on the day of the initial visit revealed 1+ albumin, 1–2 rbc and 1–2 wbc per high power field, alkaline reaction, and specific gravity of 1.021. Repeat urinalysis three days later revealed a trace of albumin, absence of rbc, 25–30 wbc per high power field, alkaline reaction, and specific gravity of 1.024. Subsequent urinalyses have been essentially normal.

The case presented above is reasonably typical, although certain differences in the cases did exist. The chief symptoms and findings observed in all six cases are summarized in the table above. The cough encountered was generally nonproductive and hacking in character. The mucous membrane injection was never extreme or fiery but of slight to moderate degree. Those cases classified as febrile ran temperatures of 99° F to 99.6° F for two to three days and then became normal. The patient showing hemoptysis experienced slight expectoration of a faintly blood-streaked sputum on two occasions. During subsequent observations, it was decided that the bleeding probably originated in the paranasal sinuses rather than the tracheobronchial tree, but this was never proved. The incident did not recur.

Summary of Symptoms and Findings

Symptom and Finding	Case Number						No. with Trait
	1	2	3	4	5	6	
Headache	+	—	+	+	+	+	5
Cough	—	+	+	+	+	+	5
Sore throat	—	+	+	—	+	—	3
Dizziness	+	—	—	—	—	—	1
Anorexia or nausea	+	—	—	—	—	—	1
Abdominal discomfort, vague	—	—	+	—	—	—	1
Injection of pharynx	—	+	+	+	+	—	4
Injection of nasal membranes	+	+	+	—	—	—	3
Fever	—	+	+	—	+	—	3
Hemoptysis	—	—	—	+	—	—	1
Albuminuria	+	+	+	+	+	+	6
Microhematuria	+	+	+	+	+	+	6
Pyuria	+	+	+	+	+	+	6

Albumin was found in all urine specimens initially but only in trace or 1+ amounts. Microhematuria was limited to 3–4 rbc per high power field. Pyuria varied from 1–2 wbc per high power field up to 25–30 wbc per high power field. All of these urinary findings were transient and subsequently cleared except in Cases 2 and 6. In the former the findings of microhematuria and trace albuminuria were noted to persist in specimens taken one year after exposure, although the patient continued to be asymptomatic. Case 6 had a history of recurrent pyelonephritis. Several episodes of pyuria, hematuria, and albuminuria occurred both prior to and subsequent to the incident under study. For this reason, urinary findings in this case were considered noncontributory to this investigation.

From the evidence presented, it appears that the six workmen were exposed to an unknown agent or combination of agents which produced irritation of the mucous membranes of the upper respiratory tract. The occurrence of secondary infection accompanied by low grade fever explains the fact that three of the patients continued to develop new symptomatology after the exposure had ceased. Microhematuria, pyuria, and slight albuminuria occurred in all six patients, indicating a possible nephrotoxic action. Two of the workmen had previous occurrences of microhematuria and

albuminuria, but the other four had essentially negative previous genitourinary histories. Vague abdominal symptoms in two patients could be interpreted as due to liver involvement, but no conclusive evidence of this was obtained.

As previously stated, no respiratory protection was worn during the initial three and one-half days of work. During the latter part of the fourth day and the whole of the fifth day, supplied air respirators were worn and all the men continued to perform the job with the exception of Case 3. This patient was transferred to another job because of psychological factors with which the Medical Director had previously become familiar.

Investigation

In an attempt to identify the offending agent, the plant industrial hygiene facilities undertook analytical work on decomposition products from samples of the epoxy resin-concrete. Substances initially suspected of causing the illness were as follows:

1. *Epichlorohydrin*—This compound could conceivably result from decomposition of cured resin, since it is one of the basic molecules involved in the resin structure. A break at the ether linkage in decomposition could release a bis-phenol compound plus substances related to epichlorohydrin.

2. *Free amines*—It has been shown epoxy resins contain quantities of free unreacted amines which could be released upon destructive tooling.[1] Amines so released or amines freed as resin decomposition products might remain "free" or could conceivably form salts such as hydrochlorides.

3. *Xylene*—This was suspected, since it is a known constituent of the resin precursors and its odor had been tentatively indentified at the work site. At first thought, it may appear unlikely that so volatile a compound as xylene would remain entrapped in "concrete" for a year and a half. It should be remembered, however, that the epoxy resin has rendered this material totally unlike the porous concrete with which we are most familiar. The remarkable imperviousness of epoxy concrete makes the release of xylene on tooling quite plausible.

Samples of the epoxy resin-concrete were obtained and treated destructively to simulate the work conditions. Some samples were ground in a Wiley mill, others were drilled with a power drill, and some were pyrolyzed in a flask. During these operations, representative samples of dust and vapor were collected by pulling emanations through a filter and scrubber. Vapors formed during pyrolysis were recovered by condensation in cold-traps.

Results

1. No detectable quantities of epichlorohydrin were identified in the vapors from drilling, grinding, or pyrolyzing the samples. This conclusion was based on infrared and mass spectrometer analyses. No other aromatic chlorinated compounds were indentified in the spectra.

2. No detectable quantities of free amines were found in vapors from drilling, grinding, or pyrolyzing the samples. This conclusion appeared reasonable when it was found that the vapors contained no alkaline material when absorbed in water or methanol. The powdered sample also contained no water-extractable alkaline material, a hot water extract having a pH of 7.0.

3. The presence of substantial amounts of xylene was definitely indicated in all infrared and mass spectrometer analyses. The mass spectrograph indicated that approximately 90% of vapor products from pyrolysis of samples were composed of xylene. Other unknown aromatics were present to a lesser degree, however. The fragment showed up clearly. This indicated that true resin decomposition products were probably present in small amounts. The spectra also indicated the presence of small amounts of chlorine compounds, which were possibly present as a result of breakdown of hydrochloride salts of amines formed during pyrolysis.

4. When samples were ground in a mill, the evolved vapors were found to contain volatile nitrogen compounds, which were caught on silica gel and detected by the Kjeldahl procedure. A water extract of the silica gel had a pH of 5.1, indicating the absence of free simple aliphatic amines. It was concluded that if amines were present they were probably present only as salts such as hydrochlorides. Kjeldahl-detectable nitrogen compounds were also present in water extracts of the finely ground epoxy concrete. No alkalinity was present, and the extract showed 50 ppm. N_2 calculated as triethylenetetramine. This result should be a reasonably quantitative estimate of the concentration of amine salts present in the epoxy concrete.

Discussion

Observation of the job and of the simulated destructive treatment in the laboratory leads us to believe that the air-tool operation produced a very fine dust which was blown about by the exhaust from the hammer. Mixed with this dust (and possibly carried by the particles) were the

evolved vapors of xylene and other as yet unidentified vapors. Since nitrogen compounds were identified in the dust, it is quite possible that the dust also acted as a carrier for amine salts which were believed to be present. These salts (e.g., hydrochlorides) are nonvolatile except at high temperatures but are highly soluble and would readily dissolve in body fluids on the mucous membrane surfaces.

The presence of the benzene ring fragment in pyrolysis vapors indicates the probability of thermal decomposition of the resin itself. Such decomposition would release molecular fragments which are as yet unidentified. The absence of epichlorohydrin as a decomposition product indicates that a simple break in the ether linkage does not occur.

The clinical course as observed was quite different from that of "polymer fume fever," which typically produces influenzal malaise and other symptoms similar to those encountered in "metal fume fever."

The analytical studies fail to isolate conclusively the principal offender. There is suggestive evidence that the illness may represent a simple upper respiratory irritation attributable to xylene. The initial irritation was followed by secondary infection in several cases. It is equally possible, however, that the illness may be associated with exposure to resin decomposition products of an unknown nature. The nephrotoxic action is difficult to explain on the basis of xylene exposure alone, although Browning[2] has referred to this effect's having been reported by investigators in Germany.

The job in question has since been performed on many occasions using both dust respirators and air-supplied masks with equal efficacy in preventing overt irritation of the upper respiratory tract. The fact that that dust respirators are effective lends weight to the theory that the dust may have acted as a carrier of the irritant substance.

Summary

An episode is reported in which six laborers developed upper respiratory irritation from inhaling emanated dust and/or vapor during destructive removal of epoxy resin-concrete. Secondary infection occurred in three of the patients. A mild nephrotoxic action was thought to be observed in all six patients. The offending agent was not conclusively identified but is thought to have been xylene, amine salts, or other unknown resin decomposition products. Respiratory protection is suggested for this type of operation.

(The authors' address is: Union Carbide Chemicals Company, Texas City, Texas.)

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THIRD WORLD CONGRESS ON

THE PREVENTION OF OCCUPATIONAL RISKS

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The Congress has been organized by the National Safety Institute of France in collaboration with the Committee on the Prevention of Occupational Risks of the International Social Security Association, and with the International Labor Office. The central theme will be "Research and Progress in the Service of Prevention." It will be studied under three aspects: (1) The Present State of Research; (2) Progress in Technical Disciplines; and (3) Progress in Medical and Psychological Disciplines. The Congress will be conducted in four official languages: English, French, German and Spanish. The registration fee is 50 New French Francs. Payment secures the right to free copies of the reports, the minutes of the plenary meetings and the summary of the work of the committees.

Further information may be obtained from: C. V. Gruat, Instiut National de Sécurité, 9, Avenue Montaigne, Paris 8°, France.

SOME OBSERVATIONS ON

Periodic Executive Health Examinations

Charles E. Thompson, M.D., Earl A. Zaus, M.D., and Philip R. Keller, M.B.A., Chicago, Ill.

DURING the industrial expansion which has occurred since the late 1930's, a growing concern for the health of executive personnel has developed on the part of top management. There are many reasons why industry takes this attitude towards its key people, not the least of which is their economic value to the company itself. As one executive has rather bluntly expressed it, "It is easier to hire 500 workers than it is to replace one executive." As our economy continues to expand, there will be growing demands on the skills of management and a growing desire to conserve this key industrial resource. An increasingly popular tool in this area has been the periodic executive health examination.

Medicine, it would seem, has followed the trends in this field, rather than exercised a dynamic leadership, and seems, in some instances, to have felt that to provide a medical service for one segment of the population, such as the executive, would be unfairly discriminatory. On the other hand, many industrial leaders have felt a keen need to protect the health of their executives as part of a campaign to maximize the use of one of their key resources, management ability.

In recent years, sufficient work in the field of periodic executive health examinations has been completed to give some basis for their evaluation. This paper will report some specific reactions of industry, medicine and the individual himself.

Company Views

In 1955,[1] a survey was made of 400 large companies with the following results: 60% felt that periodic executive health examinations were worthwhile, and had arranged to provide such examinations; an additional 25% felt that such examinations were valuable, although they had no plan to provide such a service. Thus, a total of 85% were in favor of these examinations, at least in principle, and only 15% were opposed.

Ninety-eight per cent stated the conviction that, if such a program were undertaken, the full cost should be borne by the company. Of the remaining 2%, 1.5% thought that the cost should be divided by the company and the examinee, and 0.5% felt that the examinee should bear the full cost of the examination himself. Voluntary participation in the program was preferred over mandatory examinations by a ratio of 3 to 1. At the time of this initial survey, the problem of periodic executive health examinations had not received the attention that it has today. In the last several years, industry's opinion on the question has been brought into sharper focus.

In 1958,[2] a group of companies were surveyed after they had had some experience with executive health examinations. At this time, 98% felt that such examinations were sufficiently rewarding to the company to justify the expenditure of money by the company. The reasons most commonly given by companies for their increased interest in executive health examinations included the following, in order of relative importance: (1) discovery of previously unknown diseases; (2) improvement of executive health habits; (3) relief from health anxieties for the examinees; (4) improved daily performance by the examinees; and (5) increased and improved health consciousness of participants and their companies.

In this same 1958 opinion survey, companies were polled regarding the desired intervals between examinations, with the following results: An interval of one year was favored by 60% of the respondents; 30% favored two years; and 10% favored three years. The selections of intervals very strongly reflect the age of the persons interviewed, with the younger groups favoring the longer intervals.

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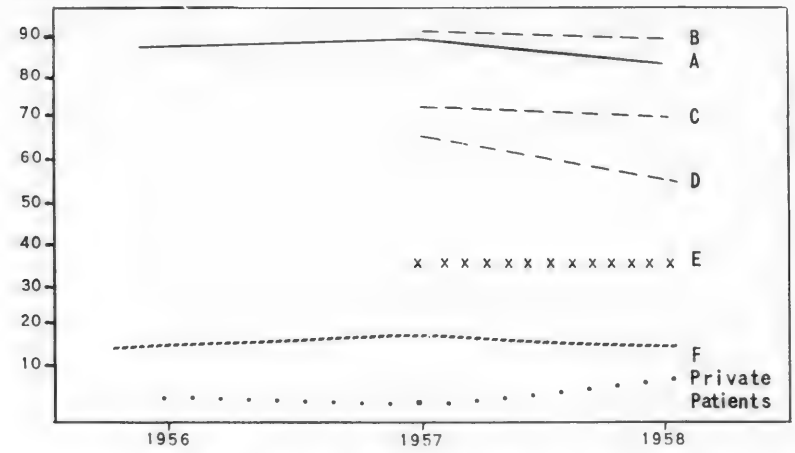
Attitudes of Executives

It is interesting to view the reactions of the individual executives to a program of periodic health examination in the light of these opinions which have been expressed by various companies.

The individual executive tends to be reluctant to be examined, either initially or repetitively. The reasons most commonly given for this reluctance are that he feels that he is in good health and does not need an examination; that he does not want to spend the necessary time away from his job; and that he objects to the inconvenience of certain preparatory procedures or the discomfort of certain observational techniques. In addition to these spoken objections, it is possible to detect a very strong undercurrent of objections based on the fear that the findings of the examination will harm the job security or promotional opportunities of the examinee.

It would seem that these unspoken objections are the most important, and that the attitude of the company toward physical examination and the general rapport between the company and its executives are of much greater importance in determining the cooperation which executives give to an examination program than are the actual mechanics of the examination.

INFLUENCE OF PAYMENT POLICIES ON REPEAT PARTICIPATION IN MANDATORY AND VOLUNTARY EXAMINATION PROGRAMS



COMPANY	REPEAT PERCENTAGE 1956	1957	1958
A	88.8	90.8	87.8
B		91.5	90.7
C		73.5	72.7
D		65.7	58.0
E		36.0	35.0
F	14.3	16.9	16.3
PRIVATE PATIENTS	3.9	1.8	7.3

KEY: ——— Mandatory Examination, full company payment
– – – – Voluntary Examination, full company payment
x x x x Voluntary Examination, 20% participation by examinee
---------- Voluntary Examination, 50% participation by examinee
. . . . Private Patients

Six companies were treated in this study. All sent at least 30 executives in each of the years reported. Two of the companies first participated on a large scale in 1955, the other four in 1956. Thus, repeat-visit data are available for two companies beginning in 1956, and for four companies beginning in 1957. As a control, a seventh group was also studied. This group consisted of private individuals who met the entire cost of their own examination, and who, of course, participated solely of their own volition.

In arriving at the percentage figures used, an "eligible executive" was defined as one who had previously had a physical examination here. Dividing this number into the number of executives who actually participated gave the "percentage of repeat participation." Since this method makes no allowance for the fact that some executives who have been examined here in previous years will no longer be with the company during the particular year studied, for various reasons, such as resignation, retirement or death, it is not strictly accurate. The number of "eligible executives" is overstated, and, hence, the "percentage of participation" is understated.

The companies studied had the following policies effective:

1. CompanyA has a mandatory program and full payment by the company.

2. Companies B, C, and D had voluntary participation with full payment by the company.

3. Company E had voluntary participation with 20% payment by the examinee and 80% payment by the company.

4. Company F had voluntary participation with 50% payment by the examinee and 50% payment by the company.

Repeat Examinations

It is disappointing to a physician to think that the method of payment for these examinations is a determining factor in repeat participation, but, as the following study[3] shows, there is a very definite relationship between repeat performance and the payment policy which is followed. At the same time, it is interesting to consider another factor—the comparison between the mandatory and voluntary plans. It would seem that voluntary participation with full payment by the company, and strong support of the program by top-level management can achieve repeat performance on a voluntary basis that is equal to that of a mandatory plan. However, when the top management of the company has no firm policy regarding these examinations, and there is a partial financial participation by the examinee, participation occurs in inverse proportion to the degree of financial participation by the examinee. With 50% payment by the examinee, participation is about 15%; with 20% payment, it increases to 30%; and, when the company pays the full bill, there is at least 60% participation in the program.

In recent years, a growing amount of information has been reported in the medical journals concerning periodic executive health examinations.[4-7] The percentage of first-visit examinees who have had previously unknown diseases discovered has varied from about 25 to 55, depending on the thoroughness of the examination and the exact definition applied to the term "disease." Regardless of the exact percentage of new diseases discovered, the importance of these findings to the particular individuals involved is very great, both personally and in their relation to their companies. Many diseases are remediable, curable and controllable; and, if discovered early, can be handled in such a way as to lengthen and enhance the life of the individual.

We see two definite advantages in having such periodic examinations: (1) significant number of cases of disease are found on subsequent examinations, and (2) the percentage of executives who follow up on the medical counseling which they receive increases. Our experience in this regard is similar to that of the Mayo Foundation as reported in a recent paper[8]: the percentage of examinees who failed even partially to comply with the advice which they received dropped from 20% at the time of the first visit to 10% by the third visit. Even this small percentage of persons who appeared to completely ignore the recommendations of their examining physicians must have benefited, to some extent, from receiving a complete appraisal of their state of health.

Summary and Conclusions

From the results of these two surveys and the experience of four years of study of executive health programs in action, the following conclusions may be drawn:

1. Most companies feel a definite and real need to have their executives examined.
2. The attitude of the individual executive toward an examination program mirrors, to a great extent, the attitude of the company itself toward such a program, and is influenced by the general rapport between executive and company.
3. Once an executive has had his first examination, he will participate in a repeat program in direct relationship to the percentage of the cost which is assumed by the company.
4. Medical benefits from an executive health examination program are very substantial, both for the individual himself and for his company.

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The Treatment of Industrial Hand Injuries

IV. AMPUTATIONS

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THE LOSS of part or all of a finger or hand is not an uncommon industrial injury. The frequency probably parallels the degree of mechanization of the job plus the factor of employee experience and familiarity with his work. The mechanism of injury is obvious and apparent. Injury is probably most common at both extremes of employment. The new employee may lack full appreciation for safety measures, while the "old timer" is lulled into complacency by the routine aspects of his job.

Traumatic loss of a finger may be complete or incomplete, the latter by virtue of damage to any one or more of its individual structures. This will be covered more fully in our criteria for amputation. Extensive and irreparable damage may preclude surgical repair or reconstruction.

Preliminary examination and treatment are done at the plant dispensary. Aseptic precautions are observed. One notes any obvious deformity, crushing, skin color and temperature, and peripheral sensation. Nail bed vascular rebound is a good indicator of adequate distal blood supply. The normal pink flush of the nail bed should return almost immediately after pinching and depression of the nail. An x-ray film is important not only for determination of fracture and dislocation but also as a vital medicolegal record. The film will reveal absence or distortion of soft tissue markings. With ever-increasing legal implications, accurate photographic records can be made; it might be well for each hospital operating suite to be equipped with one of the newer simple cameras. The degree of injury having been assessed, initial cleansing may be done and the part dressed and immobilized prior to transporting the patient to the hospital. Usually, hemorrhage can be controlled adequately with a snug compression dressing; a tourniquet is not necessary.

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Indications

It is our belief that conservatism is a most important attribute of the hand surgeon. Not only will such an attitude allow him to salvage many fingers, but it will also preserve valuable tissue for subsequent reconstruction if necessary. Nevertheless, ultraconservatism often is futile and proves to be a great economic loss to both patient and employer. Initial definitive surgery (i.e., amputation) obviously would eliminate the many minor revisions and reconstructive steps before a secondary amputation becomes an actuality. In a recent survey,[1] we classified our criteria for amputation as follows:

Absolute

1. Devascularization—loss of both digital vessels and skin collaterals
2. Secondary thrombosis of digital arteries—at the proximal phalangeal level due to external damage or spasm

Relative

3. Extensor and flexor tendons severed—usually in association with a fracture and just short of complete amputation
4. Extensor and flexor tendons severed—usually in association with a fracture and just short of complete amputation
5. Crushing fractures or combinations of the above

While these are often indeterminate on first examination, the indication becomes evident as cleansing and debridement proceed. In addition to the above relative criteria is another non anatomic or nonsurgical indication. While difficult for the surgeon to assess, some patients would rather have a stump in place of a motionless yet cosmetically acceptable finger. The opposite may also be true.

General Principles

We must strive to preserve length and provide for a nontender stump which has adequate tactile appreciation. Adherence to empiric levels of preference doesn't always work. One must be prepared and be capable of improvisa-

tion at the operating table. Open amputation has little place in the treatment of hand injuries, unless seen many hours after the injury or when obvious infection is present. Needless to say, the precepts and tenets of hand surgery are observed. These have been covered in previous articles (Parts I and II). In addition to fine plastic surgery instruments, one needs a Gigli saw, small rongeurs, and a fine rasp.

Five structures—skin, tendons, digital nerves, digital vessels, and bones—are handled separately as the finger is prepared for closure. Skin is treated gently, and all that is viable is saved until final length is determined. In preparing a flap, the digital fascia should be lifted with the skin. Aside from an effort to provide good tactile skin for its grasping surface, flaps may be volar, dorsal, radial, or ulnar. They should fit comfortably over the bony phalanx, being neither redundant nor too tight. Although we like an ischemic field, pressure should be released to observe skin margins for bleeding.

Tendons are severed sharply and allowed to retract provided there is no need for transfer (reconstruction in a mangled hand or one with multiple amputation). They are never sutured over the end of the bone. Contractures and restriction of motion of both involved and uninjured fingers will result.

Digital nerves are isolated and dissected free. They may be recessed from the end of the stump by cutting while gentle but definite traction is applied to them. A painful and tender neuroma invariably follows when the nerve end is sectioned distal to the bone level. Munro and Mallory[2] crush the axon cylinders without crushing the sheath and then ligate the nerve. We usually ligate the nerve with fine No. 100 cotton or 5-0 gut. In the finger it is difficult to bury the end in soft tissue but accurate identification and then recession can be done easily.

Digital vessels are identified within the neurovascular bundles and are ligated separately. More effective treatment of each is possible where nerve and artery are handled as individual structures.

Properly sculptured bone ends result in a better stump. Less splintering of bone occurs with the use of a Gigli saw. When rongeurs are used to cut bone or to contour the tip, small bites are preferable for the same reason. It is not necessary to excise cartilage, but the condyles should be shaved off and rounded (Fig. 1.).

Upon completion of the surgical revision, skin flaps are approximated with fine interrupted sutures (4-0 and 5-0 nylon). Drains are not used. An even fluffy compression dressing is applied and the hand immobilized over a splint. Unless severe pain, fever, or drainage is present, dressings are left intact for five to seven days. Sutures are removed in 10 to 14 days. Warm soapy soaks and active exercises are started at the end of two and a half to three weeks.

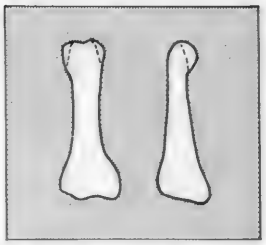

Fig. 1—Left, the dotted line passes through that portion of the condyles which should be removed. Right, a lateral view of the phalanx shows that portion of the volar lip to be removed.

Distal Phalanx—Our discussion of specific levels of amputation will imply that total or near total traumatic amputation has occurred. Also it implies that thorough cleansing, copious irrigation, and debridement has been done. The procedure may be done very satisfactorily with use of local anesthesia and on an outpatient basis. However simple it may appear, it warrants operating room facilities.

Fingertip loss of the distal phalanx of all fingers and thumb can be closed with a thick split graft taken from the volar aspect of the same forearm. At least one-third of the nail bed should remain; less than this amount will usually present too large a bony surface to accept a free graft. The graft is secured with several interrupted sutures of 5-0 nylon. Fine mesh gauze, nylon gauze of fine mesh impreg-

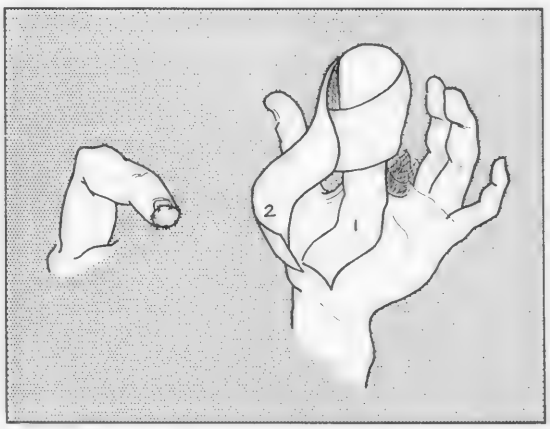

Fig. 2—Finger tip amputations. Left, a thick split graft is obtained from the volar surface of the forearm and cut to the size of the defect. Right, the dressing used consists of several fluffs over the end of the finger held in place with Elastoplast. Elastoplast is cut lengthwise and one strip is started over the dorsum of the hand and carried over the finger to the palm. The other strip is circularized about the finger.

nated with nitrofurazone (Furacin) is used to cover the graft. A fluffy compression dressing is held in place with strips of Elastoplast (Fig. 2.). The use of a curved finger splint will add to the patient's comfort postoperatively. Dressings are not disturbed for five to seven days; sutures are removed at the end of 14 days. A light protective dressing may be used for another few days.

Other methods used to close these wounds are the rotation, cross-finger, and palmar flaps. Since the free grafts take so well and are highly serviceable, we have felt it unnecessary to use flaps. Immobilization of other fingers and palmar scarring are disadvantages to the use of flap technique.

Proximal and Middle Phalanges—Except in the thumb, amputations with less than a third of the nail bed remaining, are revised best through the distal interphalangeal joint. One may avoid a bulbous stump by removing the condyles of the middle phalanx and rongeuring the bone to a smooth round cone. Revision of the middle phalanx may be done through the distal two-thirds of the shaft; little is gained by preserving only the base. Anything less than a three-quarter length of proximal phalanx is considered valueless as the phalanx usually remains semiextended and forms too large a gap between adjacent fingers. One need not adhere to these limits if it appears that a less desirable level would save tissue for other subsequent use (Fig. 3.).

Amputations of Specific Fingers

Thumb—The function of opposition is so very important that all possible length should be preserved. Thumb-tip loss can be treated in a manner similar to that for the other fingers. For loss of the distal phalanx and the distal portion of the proximal phalanx, further sacrifice of length is prevented by providing coverage with skin flaps from adjacent fingers or from the abdomen. Amputation in the area of the metacarpophalangeal joint presents a greater problem. Phalangization or deepening of the web space will not increase its length but will provide a greater functional length. An irregular incision such as the Z-plasty may be useful in going through the web. This maneuver is done best as a secondary operation. Available skin will determine the necessity of other shifting procedures or grafting. Part of the thenar musculature must be excised or increased depth will not be attained. However, sufficient muscle should be retained to allow satisfactory strength of adduction. Digital (index finger) transfer or bone graft with a tube flap are more formidable procedures which

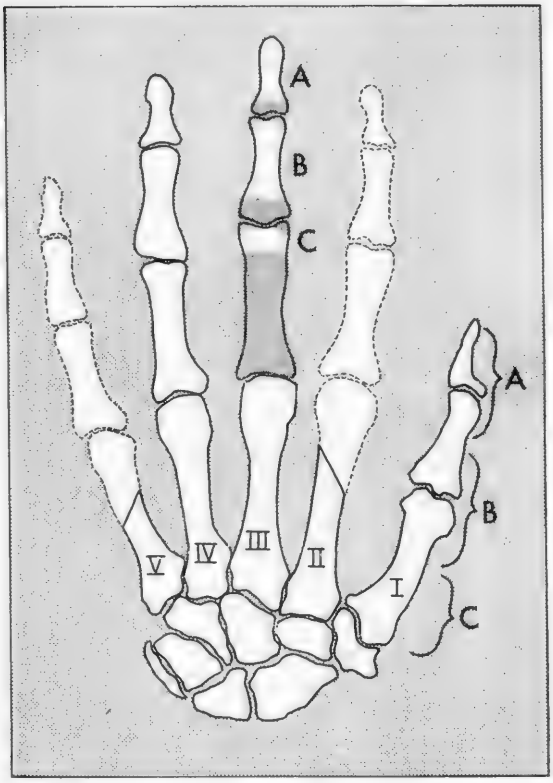

Fig. 3—Amputations of specific fingers.

I. Thumb. A. Prevent further loss of length by covering with skin graft or skin flaps; B. Phalangization, tube flap with bone graft, and digital transfer may be used for amputations at this level; C. Tubed flaps with bone graft or digital transfer may be used for these near complete losses.

II. Index finger. For Complete loss of this finger revision is through its metacarpal.

III. Middle finger. A. Preferred level for revision through the distal phalanx of all four fingers; B. Preferred level for revision through middle phalanx of all four fingers (condyles must be removed); C. Preferred level for revision through proximal phalanges of the four fingers but condyles must be excised. A shorter stump is not objectionable in the little finger.

VI. Ring finger. The little finger is a good substitute for this digit.

V. Little finger. Metacarpal revision is done for complete loss of this finger.

may be used. These methods are available to provide an opposing thumb when the proximal portion of the metacarpal is lost. Both are lengthy and staged operations. Kelikian[3] describes the detailed technique of index finger substitution.

Index Finger—The contribution toward a satisfactory pinch mechanism makes the index finger second in importance. This function is maintained, at least in part, when the amputation is not cephalad to the proximal inter-

phalangeal joint. A shorter stump may serve to maintain a broad palm but its primary function is automatically transferred to the middle finger. Therefore, it assumes the role of an interdigital blocking agent between the working thumb and middle finger. Chase[4] points out that a better cosmetic and functional result may be obtained by removal of most of the second metacarpal. A racquet incision will keep the scar away from the palmar surface of the palm. Burham[5] describes an incision, which curves over the dorsal aspect of the web space, designed to leave a better non-tender scar on the dorsum of the hand. The adductor pollicis must be protected. When this metacarpal is removed added strength of abduction of the middle digit may be obtained if the first dorsal interosseous is saved and sutured to the radial side of the middle finger.

Middle Finger—Carroll[6] has devoted an entire article to amputation of this finger. Phalangeal levels are the same as used for the other digits. He suggests that proximal phalanx amputation is best treated by removal of the entire third matacarpal. The reason for this has already been mentioned: lack of good tendon pull leaves a hyper-extended stump with an undesirable gap between the ring and index fingers. Metacarpal removal alone is not enough for two reasons: (1) a gap still exists, and, (2) rotation of the remaining digits occurs. Thus, transplantation of an adjacent ray (preferably the index) should be done. An attempt to "jog" the second metacarpal into the vacated space may be difficult. An osteotomy through the middle third of the index metacarpal and amputation of the central metacarpal at approximately the same level can be done. The index finger can be moved over and maintained in position by means of Kirschner wires (intramedullary) or small bone screws (Fig. 4.). Although part of the transverse portion of the adductor requires reimplantation, the osseous maneuvering will tend to preserve the adductor mechanism which Kelikian[7] stresses as being vital.

Ring and Little Fingers—These two fingers are of less importance when individually amputated. Phalangeal levels are the same as for the other digits except that a shorter proximal phalanx stump is not as objectionable in the small finger. Use of the fifth finger for replacement of the fourth is practical. It improves the appearance of the hand and prevents the gap through which small articles may escape the palmar grasp. Often, this may be accomplished by pushing the fifth metacarpal radialward. Subsequent fibrosis will hold it in place. Further assurance of maintaining the new

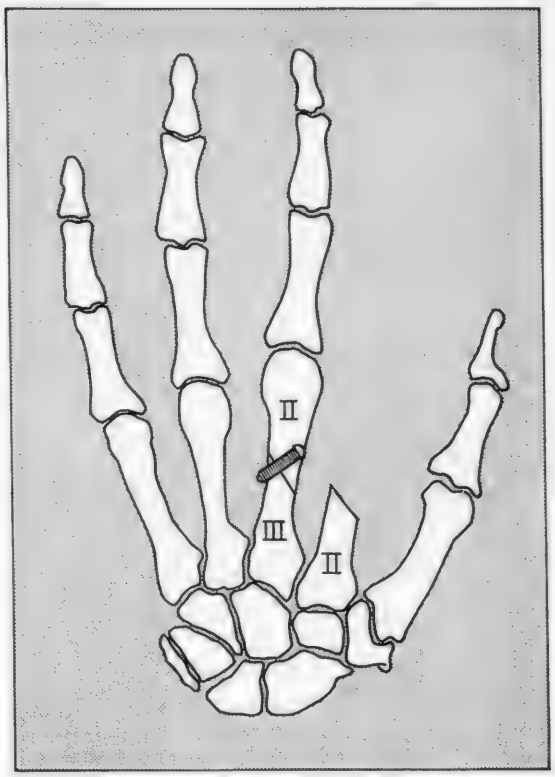

Fig. 4—Transfer of the index finger may be done for total loss of the middle digit. When an oblique osteotomy is done, a small metacarpal screw may be used to secure the transposed bone. When using intramedullary wires, a transverse osteotomy is preferable. The major bulk of the adductor muscle must be protected.

position may be added means of temporary transverse wire fixation to the adjacent rays. As an alternative, osteotomy and transfer of the distal two-thirds of the fifth metacarpal may be desired. In complete amputation of the little finger, not less than the metacarpal head should be removed. Bone is cut obliquely starting on its ulnar aspect and slanting distalward and radialward. Thus, the hand is improved cosmetically and a prominent pressure point is avoided.

While we believe in the principle of metacarpal extension, we believe that extensive metacarpal resection or transfer should be a secondary procedure. If done primarily, risk of carrying infection into the hand proper is greater; and resultant scarring would make subsequent procedures more difficult. In addition, some patients do not approve of removal of an uninvolved structure.

The injured man's occupation is considered when advising or performing major revision of an amputation. Fingers or functioning substitutes are of definite value for dexterity and

apparently for manual labor as well. A frequent complaint is that the amputee cannot lift because of a feeling of insecurity in the absence of satisfactory grasp.

Multiple Amputations

Again, this problem can be handled best by following a conservative course. All available length and tissue (especially skin) becomes very important. As numerous combinations of injuries are possible, it is impractical to set down specific rules for treatment for each. Surgical therapy must be individualized and tailored to meet the immediate and future needs of the patient. As has been implied, we tend to save all that can be expected to survive. In mangled hands, we sometimes err in attempting to preserve questionably devitalized tissue. In doing this, the risk of frank infection is not great provided thorough cleansing, irrigation, and debridement are done. When faced with four or five lifeless fingers, carefully placed diagnostic incisions can give one reassurance that a needless total amputation is not being done. Infrequently, these may disclose sufficient collateral circulation to take a chance at gaining a little extra length. A finger can always be removed, but it is impossible to create a normal new one.

When all fingers are amputated, phalangization may satisfy the requirements for a simple pincher mechanism. When a single digit remains, a working prosthesis can be constructed to allow for satisfactory pinching as may be needed in the course of the patient's employment.

Summary

Indications for primary and secondary amputation are outlined.

The technique of amputation of the digits at various levels is described.

The role of major remodeling of the hand is discussed.

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This concludes this series of reviews.

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Editorial

Don't Let It Pass

DESPITE our firm resolution not to waste this page viewing with alarm one or another event on the horizon, we now give way to what we hope will be more than a futile wringing of the hands accompanied by unheeded moans. The anguish results from reading H.R. 3556, a bill to provide for humane treatment of animals used in experiment and research. This was introduced in the lower house by Representative Morgan M. Moulder of Missouri, and will have counterpart legislation introduced in the upper chamber by Senator John Sherman Cooper of Kentucky.*

The proposed law would create an Agency for Laboratory Control, headed by a Commissioner appointed for a five-year term by the President of the United States. The Commissioner would have to be an attorney admitted to practice law before the Supreme Court of the U.S. He would receive the same remuneration and allowances as a judge of the U.S. Circuit Court of Appeals, and would not be removable during his term of office except on grounds that support the impeachment of such a judge.

The power of the Commissioner to control animal experimentation would extend to all projects supported by federal funds, which in this day and age means a major portion of research in the health sciences carried on at colleges and universities. Control would be applied at three levels, the laboratory, the investigator, and the project itself: the *where*, the *who*, and the *how* of scientific investigation. It is in the last regard, the *how* of research, that the proposed legislation provides a bureaucratic instrument for tying projects into truly impressive knots.

Applications for grants approved by appropriate study sections and meeting all other requirements for support by federal funds would have a final review by the Agency for Laboratory Control. Failure to gain approval here would stop the grant. A fundamental decision called for in this review gets at the very design of a given experiment: limitation of the number of animals used to an absolute minimum, and the type of animal selected for the experiment. Answers to questions of this kind usually are matters of opinion, with no way of settling an argument short of the experiment which is being held up. Greater snafus than this probably have occurred accidentally, but surely no well-intentioned person has deliberately planned one.

Another negative aspect of the proposed law might be called strangulation by control of trivia. As an example, an anesthetic agent would have to be administered to an experimental animal by a veterinarian or a doctor of medicine qualified in anesthesiology, or by a resident in anesthesiology working under the direct supervision of a qualified chief in this specialty. The full bill contains a list of ridiculous requirements, but none that equals this one.

The prevention of harmful exposures to industrial substances requires an understanding of their biologic action. Such knowledge may be acquired by careful observations of exposed workmen for early signs of injury, and in certain instances this may be the only kind of observation that is really useful. But we choose, wherever possible, to gain toxicity information through animal experimentation, and to move from knowledge so gained to the design of adequate industrial hygiene controls. To a degree greater than is generally realized, modern industrial health practice is thus based on animal experimentation. It is true that much of this is financed by private industry and would therefore be free of stifling harassment by the new Agency for Laboratory Control. But enough is supported by federal funds, and therefore susceptible of such interference, as to make the defeat of H.R. 3556 a matter of critical importance to the continuing success of occupational disease prevention. Each of us will see his own way of contributing his own part to this endeavor.

*Events Affecting Research Administration, Vol. 1, No. 2., National Society for Medical Research. 920 S. Michigan Ave., Chicago 5, Ill.

Book Reviews

FUNCTIONAL BRACING OF THE UPPER EXTREMITIES. Miles H. Anderson, Ed.D. Price, $9.50. Pp. 463, with 1,036 illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1958.

By D. H. CROSS, M.D.

This text is the first of its kind and a valuable aid to anyone working with patients handicapped by upper-extremity paralysis. It is written for the bracemaker and occupational therapist as well as for the physician, and technical terms are kept to a minimum. The book consists of seven units, A through G, rather than chapters.

Unit A deals with the functional anatomy of a hand and wrist. Illustrations show the muscle origins and insertions, and the function of each muscle is discussed.

Unit B is a very complete account of the functional assistive hand splint. It starts with the basic opponens hand splint and shows the many modifications possible with this device. This section is profusely illustrated, showing all the common modifications of the basic splint as well as pictures of the step-by-step fabrication of these devices. Many patterns are also included.

Unit C discusses the various types of feeders, most of which are now available commercially.

Unit D deals with the many assistive devices which are used in self-care activity and which can be used in combination with various feeder devices or the basic splint. They include buttonhook, toothbrush holder, pencil holder, glass holder, cigarette holder, and many other such devices. This chapter is well illustrated by photographs for the step-by-step fabrication of these various gadgets.

Unit E is a study of the basic anatomy of the arm and shoulder, discussing the movements at the various joints and the muscles involved.

Unit F deals with the biomechanics of functional hand splints and arm braces. A clear and simple discussion of force systems and moments of forces, including the various classes of levers, is presented in preparation for the final chapter.

Unit G closes this fine textbook with a discussion of functional arm braces. By means of cables, special harnesses, levers, etc., the various parts of the paralyzed upper extremity are moved by activity of uninvolved muscles elsewhere in the body. Much of this chapter, however, is now obsolescent and of historical value only. Since the compiling of this material and the final publishing, at least several years have passed.

With the development of the nylon muscle in that period, a completely new method of activating mechanical devices is now possible, with the advantages of lightweight plastic tubing carrying CO_2 from a small cylinder to the nylon muscle. The flow of gas activating the muscle is easily controlled by small valves that require little pressure to activate. The tension can thus be kept on the nylon muscle indefinitely without fatigue to the patient. Undoubtedly Dr. Anderson will publish his work on this new device in the very near future.

Dr. Cross is Consultant in Physical Medicine and Rehabilitation, Harmarville Rehabilitation Center, Pittsburgh, Pa.

COURTROOM MEDICINE. Marshall Houts. Price, $14.00. Pp. 511, with 247 illustrations. Charles C Thomas, Publisher, 301-327 E. Lawrence Ave., Springfield, Ill., 1958.

By E. L. WALSH, M.D.

This text, as noted by the editor in the foreword, is an attempt to bring understanding between the physician and the attorney and to clarify the needs in the medicolegal forum common to both professions. The subject matter was developed around the responses to questionnaires sent to attorneys throughout the United States; those areas wherein the greatest medicolegal interest was expressed were included.

The main text of 372 pages includes 30 chapters by eminent authorities. Most of the specialty areas of medicine are presented by the 28 essayists. The glazed stock; the open, legible print; the double column format; and the volume size make this a readable reference text. An additional chapter, "Medical Terms Defined for the Layman," is included. Approximately 3,300 terms are defined in 133 pages. A brief, but adequate, five-page index and a six-page outline-type table of contents complete the treatise.

The material of this book has been prepared primarily for the attorney. It is well presented. The physician will find some of the medical material to be "old hat," but the breadth of coverage permits a refreshing review of unfrequented specialty areas. The legal chapters on the "Expert Witness" and "Evaluation, Negotiation, and Settlement of Personal Injury Claims" give insight to the legal approach and clarifies some of the interprofessional misunderstanding.

In a compilation of synopses of medical specialties, it is obviously impossible to cover the entire field in a volume of this size. Complete coverage in each of the specialties cannot be expected. The editor in selecting instructors for the many specialties symposium has yielded command of the goal of brevity, clarity, objectivity, and noncontroversiality of some of the individual presentations. Some important specialty areas have been omitted; the editor recognizes this in the foreword and plans their inclusion in subsequent revisions. In certain chapters the specialist's enthusiasm for particular techniques or tests may be controversial or at least not based on sound, objective analysis in the eyes of many readers. There is repetition in some overlapping specialty areas; this fault is common to all

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multiauthored texts. This reviewer, however, considers it a refreshing advantage because of the differing emphasis and manner of presentation.

This first edition was found to contain about 42 typographical, descriptive, factual, and collative errors which have been forwarded to the editor.

Any reader will challenge some statements presented, but this volume is recommended as a good synopsis of medicine for the lawyer.

HEALTH PLANS AND COLLECTIVE BARGAINING. Joseph W. Garbarino. Price, $5.00. Pp. 301. University of California Press, Berkeley, Calif., 1960.

By ASA BARNES, M.D.

The growth of union health plans under collective bargaining in the San Francisco Bay area has paralleled or in some ways has been a little ahead of such development in other parts of the country. A study of this development is a good background to an understanding of the role of labor-management health plans in financing medical care.

Collective bargaining is described as a process of accommodation between two organizations, the union and the business firm. Bargaining over health insurance programs has increased the use of collective bargaining as a decision-making process and has introduced some of the forms and techniques of bargaining into a different set of organizational relationships. Unions, labor councils, employer associations, state and county medical associations, insurance companies, and medical service organizations have been confronted with new problems.

Garbarino has gone into the structure and function of the medical market on a national level and the impact that the large sums of money made available through the prepayment mechanism of health insurance has had on that market. Health insurance has become an important part of the fringe benefit package in collective bargaining, and this has brought the labor union into the picture as an organized and, in some cases, militant consumer group. During the years, the suppliers of medical service, the insurance agencies, and the unions have been working out new relationships with varying degrees of success.

This volume traces some of the successes and some of the failures in the attempt to provide diversified programs of medical care under collective bargaining in the San Francisco Bay area. The problems encountered are fairly typical of those of other parts of the United States. Solutions, notable by their absence in this area, are the development of union health centers and union-sponsored self-insured plans. Some of the dual-choice plans that have been developed are unique to this section.

The book concludes with a look into the future of the socioeconomics of medical care. In this field, Garbarino's guess, based on what has taken place in the past, is as good as anyone's. There is a broad spectrum of possible medical arrangements, the situation is fluid, and there is no reason to assume that a single fixed solution, applicable to all groups for all times, will evolve.

Dr. Barnes is Area Medical Administrator (Louisville, Ky., area) for United Mine Workers of America. He is an abstracter of the literature of his field for this journal.

RADIATION: USE AND CONTROL IN INDUSTRIAL APPLICATION. Charles Wesley Shilling, M.D., Sc.D. Price, $6.75. Pp. 223. Grune & Stratton, Inc., 381 Fourth Ave., New York 16, N.Y., 1960.

By JAN LIEBEN, M.D.

This monograph provides relevant and needed information about ionizing radiation, its origin, uses, effects, control, and prevention and treatment of radiation injury in nontechnical, easily understood language. The 223 pages offer answers to most of the questions which might be posed to the physician in this subject. The chapters on radiation effects summarize most of the presently available information on radiation injury, from the tragedies of the radium-dial painters who tipped their paint brushes with their lips to the victims of Hiroshima and Nagasaki. It discusses most of the incidents and injuries which have occurred at the various Atomic Energy Commission installations since World War II and also those which have occurred among the isotope licencees. Particularly useful is the chapter on radiation safety which discusses the organization of the program—laboratory design, protective clothing, safe handling of isotopes and radioactive materials, and emergency procedures. Monitoring radiation surveys and radiation instrumentation are discussed in a separate chapter.

The author somewhat minimizes the genetic effects of radiation and becomes overprotective in the chapter on medical exposure where he suggests that every x-ray unit should be placed in a room equipped with protective shielding of concrete or lead or should be located underground in the side of a hill and remote from people. Such precautions are unnecessary when the x-ray beam is properly coned, limited in its direction, and consideration to occupancy factors is given.

On several occasions, such as on page 97 under radiation area and again on page 140 under permissible dose, the author discusses certain procedures as company policy and gives the impression that there is much more freedom in the interpretation of Atomic Energy Commission (A.E.C.) and state regulations than there actually is.

Radiation areas and permissible dose are clearly defined in both the A.E.C. regulations and in the model codes of the National Bureau of Standards and do not permit as much interpretation as the book indicates.

Apart from the above criticism, this reviewer feels that this little book is a very valuable one not only for the industrial physician but also for the hygienist, industrial nurse, safety engineer, and any other person interested in radiation protection. It certainly should be one of the first books on the bookshelf of every person who may come in responsible contact with isotopes or other radiation sources.

Dr. Lieben is Director, Division of Occupational Health, Department of Health, Commonwealth of Pennsylvania, Harrisburg, Pa.

Questions

The questions published in this column are edited versions of requests for information that have been received during recent months. The answers have been prepared by one or more competent authorities in the particular area covered by the question. Readers may address questions to the Editor.

QUESTION: *What are the appropriate functions of a chiropodist in an industrial medical department? What additional training is recommended for a licensed chiropodist about to be so employed?*

[EDITOR'S NOTE: The above question was published in the December, 1960, issue of this journal (page 604) and readers with experience in the matter were invited to write to the editor. Following are some of the letters received pertinent to this question.]

TO THE EDITOR: Since so many of our employees at Macy's are constantly on their feet, and the majority are women, we have found it advantageous to make available to them the services of a chiropodist. His work consists for the most part of taking care of corns and minor foot ailments. He in no way replaces a physician when medical care is indicated. He also straps feet and uses pads in case of symptomatic weak feet and advises employees concerning proper shoes. He does not treat fractures or infections. We supply him with space and equipment. In return, he adjusts his fees, which have to be approved by us, so that they are much smaller than the usual fees for such services.

I know of no special training necessary except a clear understanding of his functions, so that he does not assume the treatment of conditions usually treated by a physician.

—MICHAEL LAKE, M.D., Medical Director
R. H. Macy Company
New York, N.Y.

TO THE EDITOR: For more than 10 years a foot health program has been conducted within the framework of our industrial medical department. The service, highly regarded both by employees and by management, was reported in the literature by one of my colleagues and me (Gasque, M. R., and Holt, G. F.: An Experiment in Industrial Foot Health, *South M. J.* 46:275-278 [March] 1953).

During the early years of our program, the consulting podiatrist came to our department one afternoon a week. After the backlog of foot troubles was cleared up it became suitable to reduce his visits, and now he comes every two or three weeks. The number of patients seen at each afternoon's clinic varies between 20 and 35.

The podiatrist's services principally involve the padding of corns, bunions, and bony prominences; the trimming of thickened and deformed nails; the fabrication and arrangement of supports for relaxed arches, etc. Advice and counsel in the management of problems such as fungus infections and ingrown nails is provided. Periodic foot care and counsel are offered to all employees with diabetes and peripheral vascular diseases. The podiatrist is also consulted in various other matters, such as the selection and fitting of safety shoes, sanitation in locker rooms and showers, and the selection of floor coverings for greatest foot ease.

The majority of the patients referred to the podiatrist are selected by the departmental physicians, who uncover foot ailments at the time of preplacement and periodic physical examinations. A physician's examining room is easily adaptable for use as space for the clinic. Podiatric supplies and most of the necessary equipment, including x-ray, are furnished by the industrial medical department. The podiatrist furnishes special equipment as needed. The industrial nursing staff schedules appointments at intervals of 10 to 15 minutes. One nurse is assigned to provide routine assistance to the podiatrist.

Fees for the podiatrist's services can suitably be adjusted consistent with prevailing local rates for consultants, as, for example, those paid by Veterans Administration hospitals. In our case, we pay $50 for an afternoon, which includes professional services and mileage.

—MAC ROY GASQUE, M.D., Medical Director
Olin Mathieson Chemical Corp.
Pisgah Forrest, N.C.

TO THE EDITOR: In the December, 1960, issue of JOM, there was included a question about the chiropodist in an industrial medical department. May I point out that in the April IMA meeting, a full half-morning will be devoted to a review of podiatry and current programs in industry. The speakers currently are combing the land and the literature for background information, and it should be a top presentation. It might be worth a mention that with the publication of their papers, there will be in the literature for the first time a full compilation of available material on the podiatrist and ongoing industrial programs on industrial podiatry.

—J. S. FELTON, M.D.
Professor of Occupational Health
University of California Medical Center
Los Angeles, Calif.

TO THE EDITOR: The functions of a chiropodist in an industrial medical department are determined largely by the limits and extent of the medical director's program.

Primarily, the chiropodist functions as the administrator of an industrial foot health program. This program can include examination, diagnosis, first-aid treatment, and prevention of foot problems in the work population. Routine maintenance of diabetics, peripheral vascular patients, and other special hazard cases falls within his scope. Training and supervising personnel in the safety shoe program would be another major contribution. In-

spection and control of the work environment insofar as it applies to his field is an effective preventive device, just as his contributions to the safety program are. Given the proper man for the job, the medical director can use him effectively as an assistant in statistical planning and research, health education, and industrial relations activities.

Specialized training to prepare the chiropodist for his industrial role would be mainly orientation to acquaint him with the principles, motives, and practices of industrial medicine. Such training would also give him the specialized skills that he could use in the industrial environment. It should be noted that organized chiropody circles are now planning and offering just such specialized training courses.

I might add, in closing, that my personal experience with these programs has been satisfactory.

—LOGAN T. ROBERTSON, M.D.
Asheville, N.C.

TO THE EDITOR: The work of the chiropodist originally consisted of trimming toenails and removing corns. Gradually the chiropodists have succeeded in greatly enlarging their field, and it is most regrettable that in some states they have been licensed recently to perform all major surgery of the feet. Although their training has lately been increased, it certainly cannot be compared with that of a physician who has had four years of medical college training to obtain his medical degree, and after that has completed at least four years of internship and residency in orthopedic surgery, and who is not recognized as a specialist until he has passed the American Specialty Board examinations in Orthopedic Surgery.

The foot is an inseparable part of the human body, and its ailments are frequently a part of systemic diseases such as diabetes, arthritis, infantile paralysis, and other lesions of the central nervous system, ailments of the cardiovascular system, etc.

Although the chiropodist could be useful under supervision of an orthopedic surgeon for the treatment of corns and toenails, it would degrade the services available to industrial patients to leave the diagnosis and treatment of the feet in the hands of a chiropodist. It is certainly a calamity if through leniency of our democratic government the chiropodist is permitted to perform foot surgery without ever having any real medical or surgical training, and no hospital internship. Even such lesions as a corn should be and can be much better treated by a trained orthopedic surgeon than a chiropodist, who usually only removes the corn without being able to understand adequately the treatment of its cause.

Therefore, we feel that the small investment in engaging orthopedic surgeons for the treatment of feet pays great dividends and is a good investment to safeguard the feet of industrial workers whose livelihood very frequently depends upon their feet.

(The above was received from an eastern medical director and his orthopedic surgery consultant, who prefer not to be identified.—Ed.)

Publications Available

The following list of publications has been compiled on the basis of probable interest to the readers of this journal and is presented solely for the purpose of giving notice of their availability.

Physical Disability: A Psychological Approach. Beatrice A. Wright, Ph.D. Price, $6.00. Pp. 408, including bibliog. and index. Harper & Brothers, 49 East 33rd St., New York 16, N.Y., 1960.

The problems of physical disability are presented in the terms of formal social psychology as distinct from social welfare case-working. Selected chapter headings include Inferior Status Position (of the handicapped person), Value Changes in Acceptance of Disability, Self-Concept and the Perception of Interpersonal Relations, Sources of Attitudes Toward Persons with Atypical Physique, and Training in Social Skills. The book uses as a basis for discussion not separate disability categories (as blindness or crippling) but rather situations common to all disability groups of all ages. Both factors within the person and factors attributable to the environment are considered in terms of how they aid—or hinder—psychological adjustment.

Suggested Policies for Pregnant Women at Their Place of Employment. State of Illinois Department of Public Health. Price, not given. Pp. 15. Available from the Director of Public Health, State of Illinois, Springfield. Ill.

Because the number of women workers employed by industry is expected to increase by 25% during the present decade and because employers increasingly ask for recommendations concerning the safe employment of pregnant women it was deemed advisable to develop this brochure of policies. Clear policy statements are offered in three areas: early notification of pregnancy, job placement and working hours, and confinement leave. These are supported by a list of references to the pertinent literature. Forms to be used to implement a program are supplied as appendices of the brochure.

An Annotated Guide to Free and Inexpensive Health Instruction Materials. John R. LeFevre and Donald N. Boydston. Price: paper, $2.50; cloth, $5.00. Pp. 71 plus an introductory section of 35 pp. Southern Illinois University Press, Carbondale, Ill., 1959.

Almost a thousand health education items are listed for students from first grade through college. These were selected by the authors from a great number of offerings from more than 500 sources. The items are arranged by category and topic (e.g., Dental health, dentrifice). There is a brief description of each item, together with its cost and source. The introductory section provides a key to item location by student grade and teacher interest. The following criteria are said to have been applied in the selection of items: scientific accuracy, relative freedom from promotional advertising claims, suitable vocabulary for various grade levels, low cost, and good printing.

Abstracts of Current Literature

Internal Medicine

Intracranial Lesions Simulating Cerebral Thrombosis. S. N. Groch,* L. J. Hurwitz, I. S. Wright, and F. McDowell. J.A.M.A. 172:1469 (April 2) 1960. (*Bellevue Hospital, New York.)

Of 303 patients diagnosed as having cerebral vascular disease who were studied, four were found with lesions simulating cerebral thrombosis. The authors report six cases. These are presented as a warning that, although the patients' histories and clinical findings suggest cerebral thrombosis, detailed investigation with lumbar puncture, electroencephalograms, arteriography, and pneumoencephalography may be necessary before using anticoagulants.

The first case presented was originally diagnosed as thrombosis of the left internal carotid artery. Angiographic study failed to reveal an occlusion; the final diagnosis at operation was a subdural hematoma. The second case was diagnosed as thrombosis of the internal carotid artery, but at autopsy a cerebral abscess was found. The authors point out that too little attention was paid to a history of a recent sore throat and headaches. The third case was initially diagnosed as cerebral thrombosis. The final diagnosis was metastatic carcinoma, and a review of the chest film revealed a small erosion of a rib. Of the remaining cases, one had metastatic carcinoma, with the primary lesion in the lung, and 12 others at operation revealed a glioblastoma.

It is concluded that every patient with a history suggesting a "stroke" should have a complete evaluation. When the history is inadequate, when typical signs are noted, or if the patient is in the younger age group, arteriography and pneumoencephalography should be considered. —S.H.S.

Treatment of Shock and Prevention of Ischemic Necrosis with Levarterenol-Phentolamine Mixtures. G. Zucker,* R. P. Eisinger, M. H. Floch, and M. M. Singer. Circulation 22:935 (Nov.) 1960. (*Department of Medicine, Beth Israel Hospital, New York, N.Y.)

The beneficial effects of intravenous levarterenol in the treatment of shock have been marred by instances where the material has extravasated into surrounding tissues to produce ischemic necrosis. Where such inadvertent leakage has occurred, the prompt local injection of 5 to 10 mg. of phentolamine (Regitine) will prevent necrosis. Should the leakage go undetected for several hours, however, the changes produced may be irreversible.

In 68 cases of shock a mixture of levarterenol (4 or 8 mg/liter) and phentolamine (5 or 10 mg/liter) was given for periods of 1 hour to 11 days by intravenous needle or polyethylene catheter. Good pressor responses were obtained in 51 cases. Thirty-four instances of extravasation occurred in 22 patients. Only one of these developed necrosis, but subsequent investigation revealed that phentolamine had been inadvertently omitted from the mixture given to this patient.

According to the authors, this procedure eliminates the one serious disadvantage to the use of an otherwise effective vasopressor drug. —J.J.T.

The Effect of Lipemia upon Tissue Oxygen Tension in Man. C. R. Joyner,* O. Horwitz, and P. G. Williams. Circulation 22:901 (Nov.) 1960. (*Edward B. Robinette Foundation, Medical Clinics, Hospital of the University of Pennsylvania, Philadelphia, Pa.)

Clinical studies have demonstrated the relationship of postprandial angina to blood lipid levels in certain persons. Experimental studies in dogs with induced myocardial infarction have shown that intravenous fat emulsions lower myocardial oxygen tension. The present study was designed to determine whether lipid levels in man are related to tissue oxygen tension levels. The skin was chosen for study because of its accessibility. The method chosen involved the intradermal insertion of platinum electrodes into the skin of the toes for determination of cutaneous oxygen tension by a polarographic technique. About four hours after a standard fat meal, the subjects were given intravenous heparin which induced clearing of the plasma as measured by a turbidimetric method.

Although it was not possible to correlate percentage clearing of plasma turbidity directly with the change in tissue oxygen tension, there was a mean rise of 21.7% in skin oxygen tension as plasma was cleared. A similar change was noted in a patient with spontaneous clearing. Placebo injections or injections of heparin did not produce the described effect.

The authors theorize that lipemia hinders oxygen diffusion from red cells to tissues possibly by coating the red cells, changing the viscosity of the blood, or increasing sludging of blood in the smaller vessels. —J.J.T.

Rarity of Hepatic Metastases in Cirrhosis—Misconception. E. R. Fisher,* H. R. Hellstrom, and B. Fisher. J.A.M.A. 174:366 (Aug. 24) 1960. (*University Drive, Pittsburgh 40, Pa.)

The concept that extrahepatic carcinoma rarely metastasizes to the liver in patients with Laennec's or nutritional cirrhosis has been widely accepted.

Through animal studies, the authors observed that this concept might be in error. They therefore reviewed 2,865 consecutive autopies on male subjects. Laennec's, or nutritional, cirrhosis was found in 7.4%. Coexistent extrahepatic carcinoma was observed in 13.1% of these; hepatic metastases occurred in 39.3%. One third of the extrahepatic carcinomas orginated in the head and neck.

The study did disclose that extrahepatic carcinoma in cirrhotic patients is rare. This rarity may be in part due to the fact that a significant number of cirrhotic patients die at an early age and extrahepatic carcinoma does not have the opportunity to develop.

This careful analysis of postmortem material indicates that the rarity of liver metastases in cirrhotics, even from distant primary sites such as the head and neck, has been a misconception.

—S.H.S.

Hemorrhage from Leiomyomas of the Gastrointestinal Tract. B. J. Huntley,* A. R. Laurain, and W. H. Stephenson. Arch. Int. Med. 106:245 (Aug.) 1960. (*205 S. Hawthorne Road, Nashville, Tenn.)

Smooth muscle tumors of the gastrointestinal tract are usually benign and may be asymptomatic except for bouts of acute upper gastrointestinal tract bleeding. Lack of other signs or symptoms and negative x-ray studies warrant suspecting the diagnosis. Surgical exploration in six instances confirmed the diagnosis.

Medical Care Administration

Health Departments and Medical Care—a World Scanning. M. I. Roemer.* Am. J. Pub. Health 50: 154 (Feb.) 1960. (*Sloan Institute of Hospital Administration, Cornell University, Ithaca, N. Y.)

The American Public Health Association in 1944 advocated administration of any program of medical care for the general population by the health departments. Their argument was that administrative integration of preventive and curative services was desirable and that this could be best achieved under a unified health department. Despite this, medical care programs developing in the United States have had little or no administrative connections with health departments. This is true of health insurance programs, medical care for the needy, workmen's compensation, medical care for the veterans, operations of hospitals for mental disorders, and many other medical care programs.

In other countries, health service programs may be characterized as falling into four principal types: (1) free enterprise; (2) social insurance; (3) public assistance; (4) universal service. These classifications cannot be too rigid as every country has some elements of all four patterns with one of the four predominating.

The United States, Canada, and Australia are in the free enterprise group, although the last two are moving very rapidly toward the social insurance pattern. In these countries, the health department tends to concentrate on the administration of preventive services. In France, Germany, the Benelux countries, Italy, and Scandinavia, the social insurance plan predominates. The health department has little connection with the health insurance funds. The third, or public assistance, patterns of health services is found principally in Asia, Africa, and most of Latin America. Most of the services are given by salaried personnel working in hospitals, dispensaries, or health centers. The administrative pattern vests wide authority in the health department.

The universal service patterns is seen in the Soviet Union, other communist countries, and in Great Britain and New Zealand. Medical care has been made a public benefit for all persons. Hospials are owned and operated by the central government, and all personnel are paid by the government. The local health officer in the Soviet Union is responsible for all services, including hospitals and health centers.

On a world level, there is a trend from the free-enterprise toward the universal service pattern. The need for health service coordination at the local level will become more and more manifest, and our local health department may become the true community health administration of the future.

A.B.

Why Can't the Prepayment Plans Give the Public What it Wants? F. R. Smith.* Mod. Hosp. 95:86 (Dec.) 1960. (*Commonwealth of Pennsylvania, Harrisburg, Pa.)

There is some doubt as to the willingness of doctors and hospitals to work with Blue Cross-Blue Shield 100% to solve the public problem. The public is willing to pay reasonable premiums. It wants health service bills paid with a high level of coverage wherever cared for. They are increasingly insistent on payment for non-hospitalized illness. The public wants the same kind of protection to be available to all, not just the good risks, not just the employed, not just those who can easily pay the rate.

Many Blue Cross plans paying hospitals on the basis of their charges have given a blank check to the hospitals. Service contracts cannot be considered a principle apart from contracts with hospitals and doctors. Without controls on the hospital's liability, willingly given by hospitals and doctors out of recognition of their common interest to preserve private and voluntary hospitals, Blue Cross-Blue Shield cannot solve the public problem.

The public faces a major dilemma: How can it preserve all that is good in our private system of medical care and at the same time make use of government help and assistance where it will do the most good? Its understanding of the whole matter of providing high-quality health care and financing it is tragically inadequate.

—A.B.

Medicine into the Sixities. J. D. Winebrenner,* J. Tennessee M. A. 53:431 (Oct.) 1960. (*Knoxville, Tenn.)

The author speaks as a medical administrator of a "third party," the medical service of the United Mine Workers Welfare and Retirement

Abstracts

Fund—medical service that has been selectively designed to meet the needs of one specialized segment of our population. A third party is defined as any agency that provides for or shares the cost of the medical care of the patient.

The changes in medical practice during our lifetime have been great. We can expect even more in the next decade or two. At no previous time has the need for constructive medical leadership been more critical. Organized labor's concern for health service has two main interests: (1) the method of payment and (2) the quantity and character of service. They cannot understand when the medical profession is displeased by their efforts to expand the scope of medical services. Without the past support of labor to "third party" programs, the pressure for federal intervention would have been increased. While labor leaders distrust politics, they feel that their voice and influence in Washington is more respected than in Chicago.

The earliest danger is to the present system of voluntary health insurance. Unless the medical profession somehow aids in the control of waste and abuse, the inflationary factors will continue to increase premiums, and at some point the public will refuse the voluntary way.

The dilemma of American medicine is where and how to change, how to adjust to the economy of credit and prepayment, and how to preserve the role of the profession. The prestige of the medical profession is mainly a heritage of the past. We alone have not earned it. We need to reexamine our motives and our traditional prejudices. The profession needs greater faith in itself. We can afford neither isolation nor an affection of superiority. Medicine remains in an opportune position to guide, although it cannot arrest the course of events. —A.B.

Clinical Toxicology

Medical Aspects of Chemical Warfare. V. M. Sim.* J.A.M.A. 175:95 (Jan. 7) 1961. (*Clinical Research Division, U.S. Army Chemical Research and Development Laboratories, Maryland.)

The author describes the effects of exposure to "nerve gases" and the treatment of persons exposed to such agents. These compounds inhibit cholinesterase enzymes, their action being similar to that of the organic phosphate insecticides. Symptomatology is largely due to accumulation of excess acetylcholine at various sites. If the route of entry is by inhalation, initial signs and symptoms are noted in the eye, nose, and upper respiratory tract. If the main route of entry is through the skin, gastrointestinal signs and symptoms have early predominance. Treatment of casualties includes administration of atropine, respiratory resuscitation, and administration of oximes. Where contamination of skin and clothing are involved, careful attention should be paid to removal of clothing and decontamination of skin. —A.D.

Lead Poisoning in Scrap-Metal Workers. F. E. Zimmer.* J.A.M.A. 175:160 (Jan. 21) 1961. (*Department of Internal Medicine, Geisinger Memorial Hospital and Foss Clinic, Danville, Pa.)

This report describes seven cases of lead intoxication which were associated with the cutting by torch of the lead-painted steel structural members of a bridge. Several of the patients developed symptoms after but one week of exposure, and after five weeks of work, the entire group complained of gagging, nausea, anorexia, muscular weakness, generalized aching, and fatigability. Urinary coproporphyrins were present in large quantities in six of the cases, and urinary lead levels were elevated in all of the cases. Two of the patients were treated with oral calcium-disodium ethylenediaminetetraacetate, and the remainder recovered without chelation therapy. —A.D.

Recent Advances in the Pathogenesis of Silicosis. B. Pernis and E. C. Vigliani. Med. lavoro 51:427 (June-July) 1960.

The distinctive mark of silicotic fibrosis is the presence of hyalin in the granulomatous tissue. This amorphous substance differs from normal collagen in both composition and structure. Through immunochemical analysis, it is demonstrated that the components of hyalin are mainly beta and gamma globulins similar to those present in serum. Additional criteria, such as the presence of immune conglutinins in serum of silicotics and the biochemical resemblance of hyalin to fibrinoid and to amyloid, suggest the strong possibility of an antigen-antibody reaction in the formation of the amorphous components of the silicotic nodule. The observation of a conspicuous plasma-cell reaction around the dust deposits and the successive degranulation of the plasma cells, simultaneously with the greater deposition of hyalin in the center of the granuloma, strongly favor the immunological interpretations. As a matter of fact, plasma cells are considered an important site of antibody formation, and they systematically accompany any antigen-antibody reaction.

The reticuloendothelial system is undoubtedly activated by silica dust, as demonstrated by the following experiences: (1) the so-called "coal clearance," measured by the rate of disappearance from the blood of a coal particle suspension, intravenously injected, is significantly modified in animals treated with silica dust; (2) the resistance to Gram-negative infection is increased in animals treated with tridymite intravenously; (3) the bactericidal property against Escherichia coli is significantly greater in the serum of rabbits treated with quartz than in untreated animals; (4) the treatment with tridymite of rabbits permits a titer of heteroantigens, for ovalbumin, much greater

than that obtained from rabbits not injected with silica.

The lysis of macrophages appears to be the initial phase in the mechanism of antigen production. Through this destruction, fibrogenic substances with the characteristics of an antigen are set free and start the immunological process which eventually leads to the hyalin precipitation on the simple granulomatous lesions previously determined by the dust.

It is finally pointed out that the "solubility" theory of silicosis may be rejected because of the lack of effect of silica particles introduced in animals in the form of dust sealed in micropore chambers. —M.C.B.

Noise and Hearing

Temporary Threshold Shift and Auditory Trauma Following Exposure to Steady-State Noise. B. Kylin.* Acta oto-laryng. 51, Suppl. 152, 1960. (*Nybodagatan 16, Solna, Sweden.)

This monograph summarizes four years of laboratory and field research on temporary threshold shift (TTS) and its relation to permanent threshold shift (PTS) conducted by Dr. Kylin and his associates at the Swedish National Institute of Public Health. The laboratory studies on TTS were published separately and have already been reviewed in the July, 1960, issue of JOM (p. 362). The present report also includes some data relating PTS to the intensity of the sound field. From noise measurements made at 11,300 places in 2,380 factories, a group of industrial locations was selected at which a steady-state noise with a constant sound-pressure level (SPL) had prevailed for at least 10 years. These locations were then divided into six groups on the basis of over-all SPL: below 80, 80-84, 85-89, 90-94, 95-99, and 100-104 db SPL. (Because of the similarity of spectra in the various locations, successive groups also differed by about 5 db in those octave bands most important in producing threshold shifts.) Then, for each noise group, approximately 20 subjects were selected who had worked in the noise in question for 10 to 15 years; audiograms were taken on these workers at the beginning of a working day other than Monday (i. e., after no more the 16 hr out of the noise). The results show that the average PTS at 3000, 4000, and 6000 cps is proportional to the SPL of the noise in which the subjects had worked. Workers in noise below 85 db SPL over-all (or about 75 db SPL each in the octave bands 600-1200, 1200-2400, and 2400-4800 cps) did not differ from a control group in sensitivity, but those working in levels of 100 db over-all (90 db in octave bands) showed 30 db greater loss. It is pointed out that the figure of 85 to 90 db SPL over-all as a lower limit for measurable permanent effects is in agreement with other investigations. In order to determine the relation between sex and susceptibility to PTS, the hearing of 17 women who worked in the noisier environments was compared with that of a group of 17 matched male controls. The women clearly had better hearing than the men at 2000, 3000, 4000, and 6000 cps, although the difference was always less than 10 db. —W.D.W.

Acoustic Trauma Following Intermittent Exposure to Tones. D. H. Eldredge,* W. P. Covell, and R. P. Gannon. Ann. Otol. Rhin. & Laryng. 68.723 (Sept.) 1959. (*818 S. Kingshighway, St. Louis. Mo.)

Guinea pigs were exposed to high-intensity (120 to 133 db SPL) 500-cps tone pulses of 20 msec duration at a repetition rate of 14 per second for various lengths of time. Measurements were made of the sound intensity necessary to produce a 3-microvolt cochlear microphonic (CM) before and after the exposure. The authors call the change in this intensity the "threshold shift for CM." An earlier study had shown that a given threshold shift for CM (40 to 60 db) was produced by a given total energy; i.e., if the exposure intensity were increased by 3 db, then the 50-db shift for CM was produced in just half the time. The present study corroborates this "total energy" rule: The shift for CM was the same for a given amount of energy whether this energy was concentrated in time (as in a continuous exposure) or spread out by the short interruptions to cover a period of time 3.5 times as great. Although the authors compare this relation to a quite different one found by others for temporary threshold shift in man, they are careful to point out that many factors render this comparison very speculative. Among these are differences (1) between species, (2) in the magnitude of the "off" periods (50 msec in the present case vs. several seconds in the case of studies on man), and (3) in the measures used (CM vs. threshold shift). —W.D.W.

Surgery

The Effect of a Tibial Tubercle Transplant in Children on the Growth of the Upper Tibial Epiphysis. J. W. Fielding,* W. A. Liebler, and A. Tambakis. J. Bone & Jont Surg. 42A:1426 (Dec.) 1960. (*St. Luke's Hospital, New York, N. Y.)

In a study of the effects on the upper tibial epiphysis of transplantation of the tibial tubercle in young children, 24 transplantations were performed on 15 children for cerebral palsy or lateral dislocation of the patella. In the procedure the tibial tubercle with its epiphysis and attached pateller tendon was transplanted to a bed prepared lower and more medial and secured with a plate and three screws. The defect at the site of the tibial tubercle was left open to avoid a bone bridge across the upper tibial epiphysis. In three cases fracture occurred through the area of defect, two having angulation and one persisting despite the corrective influence of growth. It appears that with patellar advancement the posterior surface of the

patella tends to mold itself to conform to the structures with which it articulates. In all cases the plate and screw moved distalward with growth, the amount depending on the amount of growth that occurred after operation. In all cases the epiphysis of the tibial tubercle did not develop in its new location. It appeared that while the tibial tubercle might migrate distally the patellar tendon attachment migrated upward with growth and retained its same relative position. In 23 cases there was no effect on the proximal tibial epiphysis. In one case a genu recurvatum developed within five months and progressed to the point where a corrective osteotomy was necessary —O.M.

Surgical Management of Ununited Fractures of the Tibia. H. R. McCarroll.* J. A. M. A. 175:578 (Feb. 18) 1961. (*Washington University School of Medicine, St. Louis, Mo.)

McCarroll notes that nonunion of fractures of the tibia continues to be a problem. The treatment of choice is bone grafting. He briefly reviews the principle techniques available and advises the techniques of Phemister, which consist of an onlay bone graft without internal fixation and without removal of the intermediary fibrous tissue. The technique is simple and requires the least stripping of soft tissues from fracture fragments.

In addition to this technique it is necessary to have adequate overlying soft tissues and skin. McCarroll reports a series of 31 cases of complicated nonunion of fractures of the tibia. In 9 cases preliminary pedicle skin grafting was performed. The essentials of the technique were the following: an anterolateral approach to the tibia, an onlay graft of cortical and cancellous bone, an attempt whenever possible to achieve a synostosis between tibia and fibula, postoperative drainage for 10 days, a massive pressure dressing under a cast for 10 days, immobilization in a long leg cast about 6 months, a short leg double bar brace with free ankle motion, and an 8 inch cuff at the fracture area for 6 to 12 months. Using this outlined therapy, McCarroll achieved union in 29 of 31 reported cases of nonunion of the tiblia. —O.M.

Repair of Contractures of the Hand with Pedal Full Thickness Skin Grafts. Glanz.* Am. J. Surg. 100:412 (Sept.) 1960. (*Medical Center, Corpus Christi, Texas.)

Skin transplants to the palmar surface of the hand frequently present disappointing results from the standpoint of texture, color, and resilience. The disadvantages of grafts to this part include a gradual thickening with subsequent pigmentation and desquamation and the possible presence in the graft of hair follicles which can become keratotic and infected. Split grafts tend to shrink very readily, resulting in a tenuous surface which may be subject to ulceration.

Glanz advocates the use of pedal full-thickness skin grafts in reparative surgery of the hand. Such grafts are taken from the hairless region on the medial aspect of the foot, extending from just below the medial malleolus across the arch to the plantar surface. In certain instances a part of the non-weight-bearing plantar surface of the foot may be taken. In most patients the pedal donor site is adequate to supply skin coverage to the volar surface of the hand without the risk of functional impairment in the foot. These grafts have proved to be superior in texture, color match, and resilience to other types of full-thickness and split skin grafts.

The residual donor area in the foot is covered by a split skin graft. Some disability and temporary secondary deformity may result, but this has not proved to be a problem in the author's experience. Ambulation is allowed within three to five days with protective padding and elastic type dressing holding the split graft in place. Dependency of the extremity has not disturbed permanent healing of the grafted area. The postoperative dressings in the hand are the usual stent type with tie-over sutures. In almost every case a full immobilizing splint is applied to the grafted hand. The principles of skin grafting in general must be followed to achieve satisfactory results in the final function in the hand. —J.T.A.

Reappraisal of Radical Fasciectomy for Dupuytren's Contracture. G. V. Webster.* Am. J. Surg. 100:372 (Sept.) 1960. (*Department of Surgery [Plastic], the University of California at Los Angeles School of Medicine, Los Angeles, Calif.)

There are a few places in surgery where an operation may produce more disability and morbidity than it is intended to cure. This happens with sufficient frequency in radical palmar fasciectomy for Dupuytren's contracture that a careful approach to this problem seems indicated. Because of the high incidence of and/or extension after operation, this is not a simple problem.

The author makes no attempt to establish authoritative rules for surgical treatment of Dupuytren's contracture. He places considerable emphasis on a complete and individual appraisal by the surgeon of all the findings presented in each individual case. Of foremost importance is the careful selection of patients for fasciectomy. Radical extirpation of the palmar fascia with its ramifications continues to be the treatment of choice for the younger patient, but before such a patient is submitted to surgery there should be no question regarding the circulatory function of the hand and the suppleness of the skin. Contralateral occurrence in the same patient or a strong family history of the disease is an additional indication for surgery. Certain associated diseases, such as coronary heart disease, gout, Reynaud's disease, cardiovascular or pulmonary dysfunction, alcoholism, cirrhosis, or epilepsy, may be contraindications to radical operation. The heavy cigarette smoker is also a notably poor risk for the

development of good function following surgery for Dupuytren's contracture.

It is important that radical fasciectomy be performed in a thoroughly equipped operating room, and minimal tourniquet time is essential for successful performance. The method of wound closure is likewise stressed by the author. Early motion is important to insure quick return of function in the postoperative period. —J.T.A.

Radiation Health

A Difference Between Biological Effects of Gamma Rays and Heavy Ions. F. Hutchinson* and S. S. Easter, Jr. Science 132:1311 (Nov. 4) 1960. (*Biophysics Department, Yale University, New Haven, Conn.)

When irradiated with gamma rays, the eggs of the brine shrimp, Artemia salina, show the typical sigmoidal survival curve with little change at low dosage and a rapid decline in survival as a threshold dose is reached. When the eggs are irradiated with 160-Mev oxygen ions, there is no threshold, and viability can be annihilated by passage of a single ion.

This suggests, contrary to the conclusion of others, the possibility that heavy ions in the primary cosmic rays which are encountered above the earth's atmosphere may produce effects at low dose levels which would not be expected from x-ray data because of threshold effects. —W.D.N.

Atomic Radiation Hazards: Congressional Hearings on Radiation Standards. Science 131:1656 (June 3) 1960.

In questioning many expert witnesses, the Joint Congressional Atomic Energy Committee showed clear concern about the sometimes-exaggerated public reaction to radiation hazards. The Committee wishes to supply factual information to the public and thereby help to allay excessive fears.

A National Academy of Science study indicated that taking the level of natural radiation as 1, the level of manmade radiation would be about 0.9. Most of this (85%) comes from medical and dental diagnostic x-rays and an additional 8% from therapeutic x-rays. Nothing else appears to account for more than 1% of the total manmade radiation. Fallout, television sets, and luminous dials each contribute about 1% of the manmade total.

Approximately 40,000 Americans die as a result of auto accidents every year, yet no one recommends that automibiles be outlawed. Standards are formulated for drivers, highways, and cars to keep the level down to a point which society appears to be willing to accept. In the case of radiation, similar reasoning leads to setting standards, necessarily arbitrary, of acceptable degrees of risk in various situations and using every reasonable means to minimize radiation exposure, even for cases which are well below acceptable levels, in order to minimize damage within this acceptable range.

Abstracts

Accordingly, the current standards set by various groups range from one to two times the background radiation as an average for the population at large. It is assumed that this will not result in the exposure of many people to more than five times this level, and this, it is felt, still leaves a substantial margin of acceptable risk. Much higher levels have been set for special occupational groups, just as society allows miners, construction workers, and other groups to accept hazards which would not be acceptable for the population at large. —W.D.N.

The Present Status of Food Preservation by Ionizing Radiation. N. W. Desrosier.* Atompraxis 8:293 (Sept.) 1960. (*Purdue University, Lafayette, Ind.)

While enough food is produced to satisfy the needs of all, a major portion never benefits man, and a majority of the people of the world go hungry. Even in the United States, we lose almost one-fourth of our perishable foods. There is hope that the use of radiation will add greatly to present methods of disinfection and stabilization of foods. Where sterilization is not complete, radiation treatment may extend the useful refrigerated storage and distribution life by a factor of 5 to 10.

Radiation produces changes in food because of its ability to initiate chemical and nuclear reactions. Hence, questions of the health and safety of such treated foods arise. Taste of the food may also be altered. Before such food is consumed, there must be conclusive proof that undesirable effects will not result. Research to satisfy this point has been in progress for several years in many countries. Consideration has been given to process modifications to minimize taste changes. Addition of useful elements destroyed in the process may be made after sterilization. Following animal tests, showing absence of toxicity, some irradiated foods have been consumed by human volunteers without detectable deleterious effects to date.

A tremendous amount of penetrating radiation will be required. Some 5,000,000 rads of radiation are required to sterilize a pound of meat, but estimated cost is less than one cent per pound.

It is hoped that the further elaborate studies, necessary to develop convincing proof of the absence of noxious changes and the nutritional adequacy of the treated foods, will be carried out rapidly. Opportunity for greatly improving the storage and distribution of food to prevent wastage in a world of want is tremendous. The outlook of researchers is cautiously optimistic. —W.D.N.

Protection of the Embryo Against the Congenital and Lethal Effects of X-Irradiation (Part 1). R. Rugh* and E. Grupp. Atompraxis 6:143 (Dec.) 1960. (*M.T.A., Radiological Research Laboratory, Columbia University, New York, N.Y.)

The effect of 15 agents has been studied for their effectiveness in protecting the 8.5-day mouse

Abstracts

embryo subjected to 200 r of x-irradiation against embryonic or fetal death and the development of the severe cephalic congenital anomaly exencephalia (brain hernia).

The protective agents were of two kinds: (1) chemicals such as AET, cysteinamine, cystamine, saline, insulin, etc., which were injected intraperitoneally prior to the irradiation, and (2) homogenates of living tissues such as spleen, bone marrow, liver, and whole brain of newborn homologous sources injected intraperitoneally or intravenously always after irradiation. Of all the agents studied, only cysteinamine, cystamine, and anoxia proved to be statistically protective at all.

Since tissue homogenate, such as bone marrow, is effective in protecting adult mice when injected intravenously after x-ray exposure but is not effective in protecting the mouse embryo subjected to 200 r x-radiation, the effectiveness must be limited by failure of the cellular elements to pass the placental membrane or some factor which renders the embryo less amenable to the protective action of the agent which protects the adult mouse. —W.D.N.

Dermatology

The Wet Dressing—Its Use in Acute Cutaneous Inflammation. F. C. Combes.* Indust. Med & Surg. 30:29 (Jan.) 1961. (*104 E. 40th Street, New York 16, N. Y.)

Wet dressings can be used effectively in the treatment of a wide variety of dermatoses, but the industrial physician will most readily appreciate the use of open wet dressings in acute contact dermatitis for emollient action and heat dispersion. Solutions and suspensions most frequently used for their emollient action and heat dispersion are clear tap water, skim milk, isotonic saline, aluminum acetate, magnesium sulfate, sodium sulfate, and colloid powder. Several thicknesses of soft, washed muslin are used for the dressing and are rewetted every five minutes. Open wet dressings are seldom used longer that two or three days and should be followed by a bland oil or ointment.

Wet dressings may also be used for detergent effects, heat retention, antisepsis, keratoplasty, and buffering action. —M.M.K.

Multiple Malignant and Benign Epidermal and Dermal Tumours Following Arsenic. E. Neumann* and R. Schwank. Acta dermato-venereol. 40:400, 1960. (*Charles University, Prague, Czechoslovakia)

The carcinogenic effect of therapeutic inorganic arsenicals has been emphasized frequently in the medical literature, but reports on the carcinogenic effect of organic arsenicals such as arsenobenzols are rare. There have been infrequent reports of precancerous keratoses and skin cancer following occupational use of arsenic insecticides by agricultural and factory workers and following contact with arsenous ores by miners or metallurgists.

In the reported series, of 527 patients with precancerous kerotoses or basal or squamous cell epitheliomas, the authors found a correlation between the use of arsenic, usually 20-30 years previously, and the presence of multiple extrafacial lesions. In three cases, the skin cancer was caused by spraying of trees with arsenous preparations. Arsenic was demonstrated histochemically in the skin and lesions of several patients. Seborrheic keratoses and senile angiomas may also have an etiologic relationship to arsenic. —M.M.K.

Some Unusual Allergic Reactions in Industry. M. M. Key.* Arch Dermat. 83:3 (Jan.) 1961. (*1014 Broadway, Cincinnati 2, Ohio)

Allergic reactions in industry can take many forms. The commonest is allergic contact dermatitis, which accounts for about 20% of contact dermatitis in industry. Less common is occupational asthma, which may be associated with contact dermatitis. Examples of materials producing asthma-dermatitis on exposure are metal dusts and compounds, castor bean pomace, toluene diisocyanate, spices, flour, and wood dust. Occupational urticaria is rare, but it has been caused by inhalation of aliphatic polyamines, castor bean pomace, sulfur dioxide, ammonia, and formaldehyde. —M.M.K.

Tar Photosensitivity in Mineworkers. D. M. Williamson.* Tr. A. Indust. Med. Officers 10:47 (July) 1960. (*National Coal Board, North Eastern Division, Woolley Colliery, Darton, Nr. Barnsley, Yorkshire, U. K.)

Two cases of photosensitivity occurred in British mine workers who had been working beneath an old tar distillation plant. Tar fractions were demonstrated in the underground water. —M.M.K.

Phototoxic Bullae Among Celery Harvesters. D. J. Birmingham,* M. M. Key, G. E. Tubich, and V. B. Perone. Arch Dermatol. 83:73 (Jan.) 1961. (*1014 Broadway, Cincinnati 2, Ohio)

Vesicular and bullous lesions followed by depigmentation and hyperpigmentation on exposed areas of the body are commonly noted among white celery harvesters in the Michigan celery-growing regions. Mexican and Negro harvesters are less affected by this disease. Field and laboratory studies have shown that celery dermatitis is a phototoxic reaction caused by exposure of the skin to pink-rot celery plus ultraviolet light between 3,200 and 3,700 angstrom units. Pink rot is a fungus disease of celery caused by Sclerotinia sclerotiorum and is most troublesome in cool, damp weather. The phototoxic material was shown by infrared and ultraviolet absorption spectrophotometry to conform to a furocoumarin pattern.

The cutaneous lesions noted among the harvesters are preventable by simple practices. Trousers and long-sleeve shirts provide the most effective

method of protection. Physical sun screens containing at least 5% titanium dioxide and a chemical sun screen containing 10% dihydroxybenzophenone in oil were effective preventives in laboratory tests. To be fully effective, the chemical and physical sun screens should contain water-repellent substances. —M.M.K.

Industrial Hygiene Controls

Basic Principles for Precautionary Labeling. E. J. Hogan.* Indust. Med. & Surg. 29:530 (Nov.) 1960. (*Allied Chemical Corporation, New York)

After an initial statement about the Manufacturing Chemists' Association's long-standing interest in the safe handling and use of chemicals, the author briefly traces the history of labeling practices as first adopted voluntarily by industry and subsequently fostered through governmental action. The Association's most important and comprehensive guides to good labeling practices are identified.

Special attention is given to a document entitled "Warning Labels—A Guide for the Preparation of Warning Labels for Hazardous Chemicals," written by the Association's Labels and Precautionary Information Committee, which is now preparing a fifth revision. Eight basic principles for proper labeling contained in Part I of the document, known also as the "LAPI Manual," are reviewed by the author, who includes several illustrative applications of the principles stated. Part II of the manual is devoted to the labeling of industrial chemicals, particularly those of outstanding commercial importance, and Part III deals with the labeling of pesticides sold in bulk.

Hogan evaluates the success of the LAPI program. It has the broad support of the Association's membership, and its principles have served as guides for the enactment of labeling legislation by the federal government, many states, and New York City. Furthermore, the principles have been endorsed by the International Labor Organization, and the program has served as a model for similar undertakings by other trade associations. The author notes, "The public must be led to recognize that chemical products may, on occasion, be hazardous and require care in handling, just as experience teaches us that care in handling is necessary with edged tools and with electrical and mechanical devices."

—M.K.

The Dust Control and Ventilation Services of the Quebec Metal Mines Accident Prevention Association. G. Grassmuck.* Indust. Med. & Surg. 29:278 (June) 1960. (*Quebec Metal Mines Accident Prevention Association, Val d'Or, Quebec, Canada)

The Quebec Metal Mines Accident Prevention Association appears to be an industry association somewhat comparable to the Industrial Hygiene Foundation of America, Inc., but with a somewhat narrower base. Although incorporated in 1940, its initial efforts were primarily in the direction of reduction of accidents, and it was not until "June, 1957, in recognition of the increasing importance of ventilation and dust control from the health, safety and efficiency points of view, the Directors of the Quebec Metal Mines Accident Prevention Association elected a committee for dust control and ventilation among its members and established a special service department, the Dust Control and Ventilation Services with headquarters at Val d'Or, Quebec." In describing the accomplishments of the first two years, the author states: "These Services have concentrated on ventilation problems proper at all mines and on certain dust control problems. We will add a dust sampling and counting laboratory." The Service submits reports which "describe activities, the state of ventilation and dust control at all member mines, and contain statistical data and a critical review with recommendations." The association includes 30 companies and a total of 37 mines of which "13 are gold mines, 19 base and other nonferrous metal mines, and five iron mines."

The author reviews some of the recent dust control techniques which have been used in various countries and describes some of the rating methods which have been used to evaluate the silicosis hazard relative to quartz. The rating is used in computing the share of disability contributed by the different mines in compensating the silicotic miner where the worker has had exposure in more than one type of mining industry.

The author concludes: "If we conscientiously study such publications, carefully test and intelligently apply those ideas, principles and techniques that appear to be promising under our conditions, we shall save much time and effort and render a great service to our industries, to the men that work in them, and to our country."

—E.C.R.

Report of Committee on Epidemiology of Occupational Diseases: Part I. Epidemiological Investigation of an Occupational Disease. Committee on Epidemiology of Occupational Diseases, E. C. Hyatt, Chairman.* Transactions of 22nd Annual Meeting of American Conference of Governmental Industrial Hygienists p. 70 (April 23-26) 1960. (*P.O. Box 1663, Los Alamos, Calif.)

The Committee describes in detail the epidemiological procedure to follow in the investigation of an occupational disease outbreak. Material is presented under nine major headings and each heading is then developed to insure the following of a logical and scientific procedure in order to arrive at a valid conclusion.

The procedure involves consideration of statistical methods, medical evaluations, and environmental studies and provides for the "development of final hypothesis explaining all the cases and manner of exposure and development of occupational disease." —L.W.S.

Abstracts

Experimental Toxicology

Cumulative Effects of Borane Toxicity as Revealed by a Clinical Test. D. F. Miller,* A. A. Tamas, L. Robinson, and E. Merriweather. WADD Technical Report 60-604, Wright Air Development Division, Aug., 1960. (*Wright-Patterson Air Force Base, Ohio)

Evidence for the chronic build-up of boranes in the body is presented, based on the use of a previously reported clinical test in animals and to a limited extent in humans. Detectable serum borane levels appeared within 15 minutes in animals exposed to acutely toxic concentrations of the decaborane derivative high energy fuel HEF-3 by intraperitoneal injection. Serum borane levels were elevated for three or four days after moderate exposures and up to seven days after severer exposures. If animals are not given a sufficient time to recover from acute exposures, reexposure to an ordinarily insignificant amount results in severe intoxication. Daily administration of doses producing no overt toxicity results in a gradual build up and ultimately death. The boranes accumulate in the liver and central nervous system tissue. Evidence of accumulation in workers was also noted. There is rapid penetration of intact skin, serum borane levels have reached 0.5-0.6 μg/liter four hours after skin exposure of two workers to milliliter amounts of HEF-3, which was washed off within minutes. Serum borane levels ranged from 0.7-1.3 μg/liter in workers acutely exposed to pentaborane and from 0.15-0.22 μg/liter in workers chronically exposed to pentaborane and decaborane. Routine use of the test to detect acute exposures and careful follow-up of exposure cases for delayed effects are recommended. —R.E.E.

Olfactory Thresholds of Some Important Irritant Gases (Sulfur Dioxide, Ozone and Nitrogen Dioxide) and Symptomatic Effects of Low Concentrations in Man. D. Henschler, A. Stier, H. Beck, and W. Neumann. Arch. Gewerbepath. 17:547, 1960. Occup. Hyg. Abstr. 35:866 (Sept.) 1960.

In persons exposed in a closed room for one-half hour to the gases, the smell and taste of SO_2 were noticed at 1.1 ppm; at 2.6 ppm there was an unpleasant feeling and at 5 ppm coughing. For ozone, the olfactory threshold was less than the lowest concentration used (0.02 ppm); at 0.28 ppm there was slight irritation and dryness of the nose and throat; at 0.58 ppm, coughing; at 0.9 ppm, sneezing and tightness of the skin of the face, and at 1.2 ppm, marked increase of all symptoms. NO_2 was perceptible by odor at 0.1 ppm, but complete tolerance to both odor and irritation was established with increasing concentrations up to 20 ppm. Increasing relative humidity from 60%-80% increased the irritative symptoms of NO_2 but not of the others. The threshold concentrations for comfort for long periods of exposure are concluded to be SO_2 <0.5 ppm; ozone <0.05 ppm; NO_2 <1 ppm. These levels are about one-tenth the MAC's. —R.E.E.

The Response of Guinea Pigs to Inhalation of Formaldehyde and Formic Acid Alone and with a Sodium Chloride Aerosol. M. O. Amdur.* Internat. J. Air Pollut. 3:201 (Oct.) 1960. (*Harvard School of Public Health, Boston, Mass.)

One-hour exposures of guinea pigs to formaldehyde or formic acid produced significant increases in resistance and decreases in compliance at concentrations as low as 0.3 ppm. A decrease in respiration rate and minute volume occurred at concentrations above 10 ppm. An increase in respiratory work was observed at 1-3 ppm, the greater proportion being in the resistive component. Formic acid was the more potent irritant. Resistance values returned to preexposure control values within an hour after exposure except at the highest concentrations used (40-50 ppm). When the protective effect of the upper airway was bypassed with a tracheal cannula, the response to a given amount of formaldehyde was increased. The response to formaldehyde was potentiated by the presence of a sodium chloride aerosol of submicron size, which was inert by itself. The potentiation appears to be due to the formation of an irritant aerosol entity. The effect increases with increasing aerosol concentration, but for a given concentration a maximum value is attained for the increment in response added by the aerosol. No potentiation was obtained with formic acid and the aerosol, but the response was prolonged, as occurred with formaldehyde.—R.E.E.

Bone Marrow Activity and Erythrocyte Destruction in Chronic Cadmium Poisoning: Studies with Fe^{59} on Rabbits. M. Berlin* and L. Friberg. Arch. Environ. Health 1:478 (Dec.) 1960. (*National Institute of Public Health, Stockholm, Sweden)

An increased destruction of erythrocytes and deficiency of iron in the bone marrow was demonstrated in rabbits with chronic cadmium poisoning. The destruction of erythrocytes formed before exposure to cadmium was also increased by cadmium. Parenterally administered iron improved the anemia and the general condition in the rabbits injected with cadmium. This iron changed the erythrocyte diameter from a microcytosis to a normocytosis distribution. The possibility is discussed of a blockage in transportation of iron between the intestines and the blood. —R.E.E.

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Weiner, A. L., and Fixler, Z. C.: J.A.M.A. **169**:346, 1959.

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About the Authors

► CLIFFORD L. KIEHN, D.D.S., M.D., is senior author of the article in this issue, "Skin Grafting of Burns." He has both of his professional degrees from the University of Michigan, Ann Arbor, Mich. He thereafter trained in plastic surgery at University Hospital, Ann Arbor, and then spent four years in this specialty in the U.S. Army. He was discharged from service in 1946 with the rank of lieutenant colonel, and started a practice in Cleveland, Ohio.

Dr. Kiehn is a diplomate of the American Board of Plastic Surgery. At Western Reserve University, Cleveland, he is an assistant clinical professor of plastic surgery in the School of Medicine, and a professor of oral and maxillofacial surgery in the School of Dentistry. He is on the staffs of University Hospitals of Cleveland, St. Luke's Hospital, Crile Veterans Hospital, and others.

Associated with Dr. Kiehn as coauthor is JOHN D. DESPREZ, M.D., also of Cleveland, Ohio. He holds A.B. and M.D. degrees from Harvard University, Boston, Mass. He interned at Cincinnati (Ohio) General Hospital, and then trained for eight years in surgery and plastic surgery at the University of Minnesota Medical School, Minneapolis, Minn.; University Hospitals of Cleveland, Cleveland, Ohio; and Johns Hopkins Hospital, Baltimore, Md. He returned to Cleveland to practice plastic surgery in 1956. He is certified by the American Board of Surgery and the American Board of Plastic Surgery, and is on the faculty of Western Reserve University School of Medicine and on the surgical staffs of its affiliated hospitals.

► EDWARD F. BUYNISKI, M.D., is author of the article in this issue "Psychiatry in Industry as Seen by an Industrial Physician."

Dr. Buyniski graduated from Colby College, Waterville, Maine, with a B.S. degree in 1935. He then took an M.S. degree in pharmacy at the Boston Massachusetts College of Pharmacy. This was followed by graduate work in physiology at Clark University, Worcester, Massachusetts. He received the M.D. degree from Tufts University School of Medicine in 1946 and interned at Wooster (Massachusetts) City Hospital during the following year.

Dr. Buyniski's career in industrial medicine began in 1947 when he became plant physician for the Frigidaire Division of General Motors Corporation, Dayton, Ohio. This was followed by appointments at Oak Ridge (Tennessee) National Laboratory, the Nuclear Energy for Propulsion of Aircraft (NEPA) project at Oak Ridge, and then his present position as Medical Director, Flight Propulsion Division, General Electric Company, Evendale Plant, Cincinnati, Ohio.

Dr. Buyniski has six earlier publications dealing with general subjects in industrial medicine. He is secretary of the IMA's Committee on Alcoholism in Industry, and is the Association's District Counselor for Western Ohio.

► JOHN L. DANE, L.L.B., L.L.M., is the author of the article in this issue, "Application of Workmen's Compensation Laws to Radiation Injuries." He is Assistant Counsel to Liberty Mutual Insurance Company of Boston, where he has charge of legal matters pertaining to workmen's compensation insurance, and accident and health insurance. His article in this issue was presented as a paper at the Annual IMA Meeting at Rochester, N.Y., last spring.

Mr. Dane completed his college studies at Harvard University, where he received the B.A. degree, cum laude, in 1942. He then served three years in the U.S. Navy, on destroyer duty in both the Atlantic and the Pacific theatres. After the war he attended Boston University Law School, graduating in 1949 with the degrees Bachelor of Laws and Master of Laws. He then joined Liberty Mutual.

Mr. Dane is a member of the Boston Bar Association and the American Bar Association. He is a member of the ABA's Workmen's Compensation Insurance Committee and the chairman of its Accident and Health Insurance Committee.

► BERNARD ROTHBARD, M.D., holds a B.S. degree from Long Island University, Brooklyn, N.Y., and in 1939 received the M.D. from New York Medical College, Flower and Fifth Avenue Hospitals, New York, N.Y. He interned for two years at Coney Island Hospital, Brooklyn, N.Y., and thereafter engaged in practice. During the years 1950-1955 he served as a medical advisor to the United Wire, Metal and Machine Health and Welfare Fund; and since 1955 he has been full time medical director of the Fund's Medical Center. He is the author of the article in this issue which describes the program of this Center.

► ROY E. JOYNER, M.D., is senior author of the article in this issue, "A Health Hazard Associated with Epoxy Resin-Concrete Dust." Although this is his first article in this journal and only his second medical publication, Dr. Joyner is by no means a writer-come-lately. He operates successfully in the highly competitive field of short-story writing for popular magazines and has had one radio show produced.

Dr. Joyner is a Georgia product. He attended college at North Georgia College (Dahlonega) and Emory University (Atlanta). After an interruption for war service, he attended Medical College of Georgia (Augusta), from which institution he received the M.D. degree in 1950. Thereafter, he interned at the U. S. Public Health Service Hospital in Galveston, Texas, in the environs of which there was a good industrial medical department that attracted his attention to the field of industrial medicine. He joined the medical staff of Union Carbide Chemicals Company, South Charleston, W. Va., in 1951, and in 1955 was appointed Plant Medical Director of that firm's plant at Texas City, Texas.

During the war, Dr. Joyner entered the U. S. Army Air Force as an enlisted man. He became an aerial gunner and radio operator in

B-26 Bombers in the European Theater of Operations during 1944-1945 and participated in 33 missions. He is a recipient of the Air Medal.

Dr. Joyner is a member of the Texas Industrial Medical Association and the Industrial Medical Association. He is certified in Occupational Medicine by the American Board of Preventive Medicine.

W. LEAK PEGUES, B.A., is industrial hygienist at the Texas City Plant of Union Carbide Chemicals Company. A native of South Carolina, Mr. Pegues attended schools in North Carolina and graduated with a B.A. degree with a major in Chemistry from Duke University (Durham) in 1924. Thereafter, he did graduate work in chemistry at the University of Maryland. He is a member of the Gulf Coast Section, AIHA. He has a previous publication, "Lead Fume from Welding on Galvanized and Zinc-Silicate Coated Steels," which appeared in the AIHA Journal. He is co-author of the article in the present issue of JOM, "A Health Hazard Associated with Epoxy Resin-Concrete Dust."

► CHARLES E. THOMPSON, M.D., practices medicine in Chicago, and is the owner and director of Charles E. Thompson, M.D. & Associates, a group of physicians active in the field of executive health. He is senior author of the article in this issue, "Some Observations on Periodic Executive Health Examinations."

Dr. Thompson was graduated in 1929 from the University of Nebraska College of Medicine as a Doctor of Medicine. He completed his internship and residency at the Henry Ford Hospital in Detroit. In 1932, he started to practice in Omaha and to teach at the University of Nebraska. He remained there until the war, at which time he entered the United States Army, serving from 1943 to 1946. After this period, he was Director of the Paraplegic Services at the Veterans' Administration Military Training Group in Memphis, Tenn. In 1949, he moved to Chicago to resume practice as a private physician.

Dr. Thompson is on the staff of the Chicago Wesley Memorial Hospital and of Northwestern University. He is a Fellow of the American College of Physicians, the Chicago Society of Internal Medicine, the American Heart Association, and the Industrial Medicine Association, and a Director of the Occupational Health Institute. He is the author of approximately 25 articles dealing principally with cardiovascular disease.

EARL A. ZAUS, M.D., practices medicine in Chicago and is associated with the Charles E. Thompson group in the field of executive health. He received his Bachelor of Science degree from the University of Chicago in 1919 and his M.D. degree from the same institution in 1922. After completing his internship at the U. S. Public Health Hospital and his residency at Cook County Hospital, he began teaching physical diagnosis and cardiovascular clinical medicine at Rush Medical College, Chicago. During these years, he served as field physician for the Chicago Heart Association, and was instrumental in making rheumatic fever a reportable disease. In 1933, Dr. Zaus joined the staff of Northwestern University Medical School, Chicago, where he is now an associate professor in medicine. He is an attending physician at Chicago Wesley Memorial Hospital.

He is a member of the Chicago Institute of Medicine, the Chicago Society of Internal Medicine, the Central States Society of Industrial Medicine, the New York Academy of Science, the Association for the Advancement of Science, and the American Heart Association.

PHILLIP R. KELLER received a Bachelor of Arts degree in Social Sciences from Stanford University in 1951. After serving an enlistment in the Navy, he entered the Graduate School of Business of Northwestern University, receiving his Master of Arts degree in Business Administration in 1959.

Mr. Keller is employed by Charles E. Thompson, M.D. & Associates as business manager, and, in this capacity, was responsible for compilation of some of the statistical data used in the paper.

—EDITOR

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People and Events

► SEWARD E. MILLER, M.D., has accepted a position with General Motors Corporation to develop and operate a Laboratory of Environmental Physiology in the Biological Department of the Defense Systems Division. The laboratory, which will be located in Santa Barbara, California, will undertake basic and applied research in conjunction with the needs of the Space-Air, the Land and the Sea Departments of this newly organized Division.

For the last five years, DR. MILLER has been Director of the Institute of Industrial Health at the University of Michigan. He will complete his commitments at the University through June of this year, serving as Acting Director of the Institute and continuing his appointments as Professor of Internal Medicine in the Medical School and Professor of Industrial Health in the School of Public Health.

DR. MILLER received his M.D. degree from the University of Michigan in 1931 and interned at the New Orleans Marine Hospital. He spent more than 20 years with the U.S. Public Health Service, including service in hospitals, in the field, and in Washington, D.C. He was Chief, Division of Occupational Health, USPHS, from 1951 until returning to the faculty of his alma mater in 1956.

DR. MILLER is the co-author, with RUTHERFORD T. JOHNSTONE, M.D., of the book "Occupational Diseases and Industrial Medicine," published in 1960 by W. B. Saunders Company. He is a Director of the Industrial Medical Association and is a member of the American Public Health Association, the American Industrial Hygiene Association, and the American Conference of Governmental Industrial Hygienists.

Seward E. Miller, M.D.

► PAUL R. KLEYKAMP, M.D., has been appointed Works Physician at Armco Steel Corporation's Ashland (Kentucky) Works. He succeeds the late WILLIAM H. RICE, M.D.

DR. KLEYKAMP received his premedical training at Ashland Junior College and Marshall College. He attended the Medical College of Virginia at Richmond and was graduated in 1952 with the M.D. degree. He served one year rotating internship at St. Mary's Hospital in Hunt-

Pictured at the 8th annual Nurse-Management dinner of the Greater New York Association of Industrial Nurses on February 14 are (left to right, seated) Sara P. Wagner, R.N.; Ralph F. Schneider, M.D.; Ella G. Casey, R.N.; Anita M. Harris, R.N.; Kathleen Connolly, R.N.; Eugen Deunweg; (standing) Harold H. Golz, M.D.; Catherine F. Yetman, R.N.; Ralph W. Smith; Marion M. Doyle, R.N., and George M. Saunders, M.D.

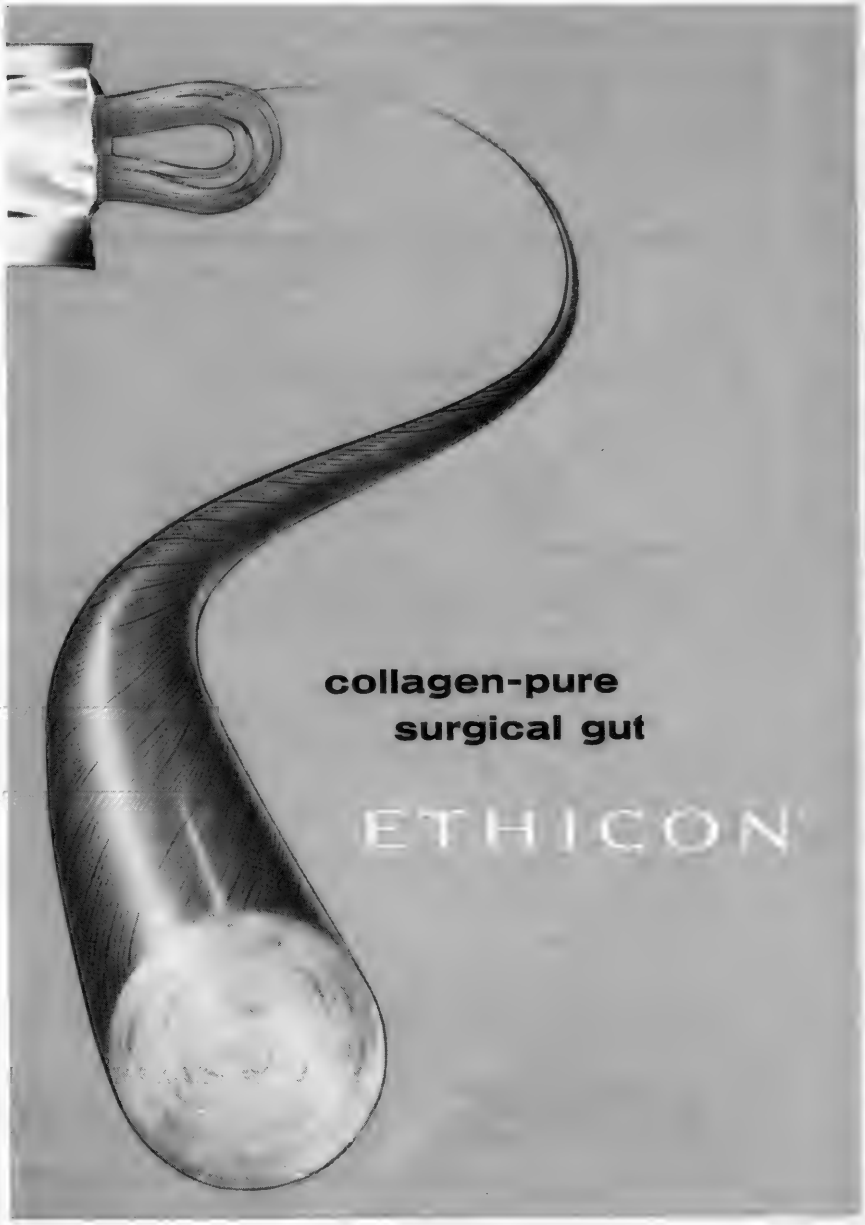
Paul R. Kleykamp, M.D.

ington, W.Va. Until accepting his present position, DR. KLEYKAMP was engaged in private general practice in Ashland. He is a staff member of the King's Daughters' Hospital and Our Lady of Bellefonte Hospital. He is a member of the American Medical Association, the American Academy of General Practice, the Kentucky Industrial Medical Association, and is a Past President of the Boyd County Medical Association.

► C. CRAIG WRIGHT, M.D., has been appointed Corporation Flight Surgeon and Assistant Chief Physician at the Pittsburgh general office of United States Steel Corporation, it was announced by ROBERT B. O'CONNOR, M.D., Medical Director. DR. WRIGHT will be responsible for all medical aspects of the Corporation's Aircraft Division operations. For the last two years he has been Medical Director for Reynolds Metals Company's Listerhill plants in northern Alabama.

DR. WRIGHT received his M.D. degree from Ohio State University in 1953. He interned at New York City's Bellevue Hospital and served in the U.S. Air Force for the next two years as base flight surgeon and Preventive Medical Officer, Shaw AFB, S.C., and concurrently as commander of the 363rd Tactical (Airborne) Infirmary. He then returned to Ohio State University for three years of residency training in preventive medicine as the Link Foundation Fellow in Aviation Medicine. His final year of aviation medicine residency was with the medical department of Pan American World Airways, Inc., at New York International Airport. He is a member of the Aerospace Medical Association, Industrial Medical Association and the American Medical Association.

► E. QUENTIN HULL, M.D., has been named Medical Director of Union Carbide Chemicals Company, South Charleston, W. Va. He was graduated from Northwestern University Medical School with the M.D. degree in 1948. He served his internship at Cincinnati General Hospital and his residency at Holzer Hospital, Gallipolis, Ohio. He was an industrial physician for E. I. du Pont de Nemours & Company for nine years prior to accepting his present position. DR. HULL served as a captain in the U.S. Army Medical Corps from 1953 to 1956, during which time he was Preventive Medical Officer, Army Chemical Center, Md. He is a member of the In-



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People and Events

dustrial Medical Association, the American Academy of Occupational Medicine, the American College of Preventive Medicine, and the American Medical Association.

► JOHN L. NORRIS, M.D., Eastman Kodak Company, Rochester, N.Y., was elected President of the American Academy of Occupational Medicine at the annual meeting held in February in Detroit. LEO WADE, M.D., Esso Standard Division, Humble Oil and Refining Company, New York, N.Y., was elected Vice-President, and S. CHARLES FRANCO, M.D., Consolidated Edison Company of New York, New York, N.Y., was elected to a three-year term as a Director. Re-elected as Secretary and Treasurer, respectively, were PAUL J. WHITAKER, M.D., Allis-Chalmers Manufacturing Company, Milwaukee, Wis., and JACK H. WOLFSIE, M.D., American Cyanamid Company, Linden, N.J.

The Academy's Award of Honor was presented to ARTHUR J. VORWALD, M.D., Wayne University Medical School, at the annual banquet.

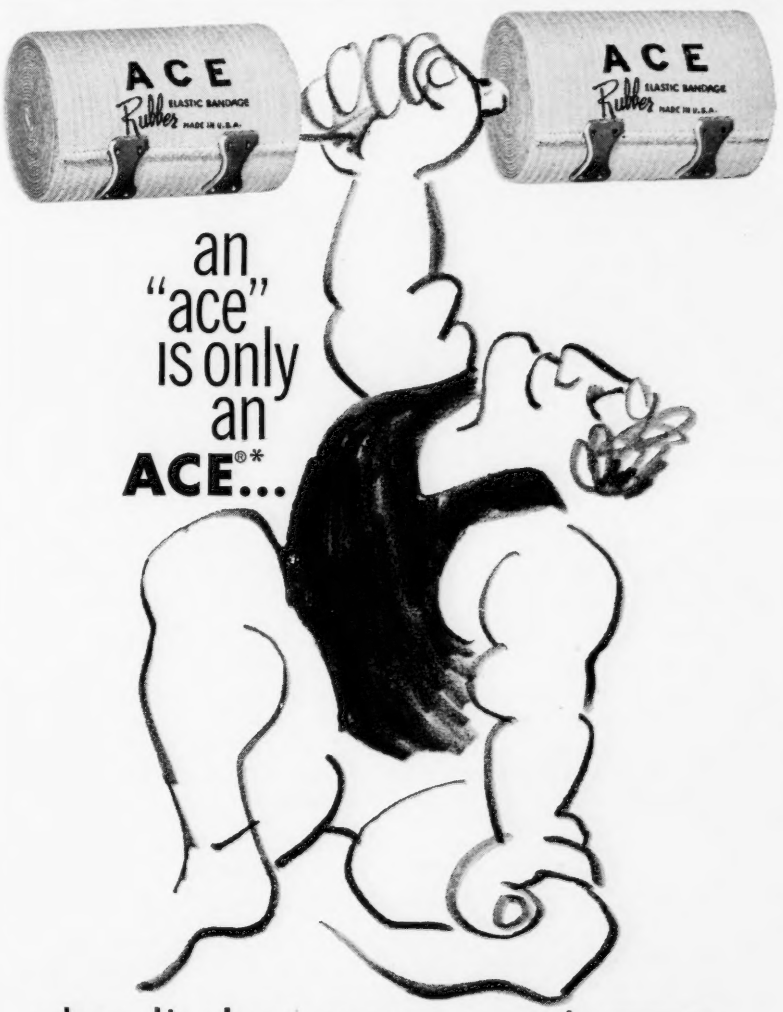
► Texas Industrial Medical Association will hold its annual meeting at the Buccaneer Hotel in Galveston on April 23. The meeting will open with a symposium on "Transportation Safety and the Physician." COL. HOMER GARRISON, Director, Texas Department of Public Safety, and SEWARD E. MILLER, M.D., Director, Institute of Industrial Health, University of Michigan, will participate in the symposium.

Other presentations will include: "Treatment of Thoracic Injuries"—EDWARD B. ROWE, M.D., University of Texas Medical Branch, Galveston; "Acute Head Injuries"—KEMP CLARK, M.D., Dallas; "Blunt Trauma to the Abdomen"—ROBERT M. MOORE, Galveston; "Eye Conditions Related to Industrial Work"—GAYNELLE ROBERTSON, M.D., Galveston; "The Use and Abuse of Antibiotics"—DAVID K. MILLER, M.D., Buffalo, N.Y.; "The Opportunity for Research in Occupational Medicine"—ALLAN J. FLEMING, M.D., Medical Director, E. I. du Pont de Nemours and Company, Wilmington, Del.; and "Cervical Syndrome"—LEWIS A. LEAVITT, M.D., Houston.

► At the mid-winter meeting of the Western New York Society of Industrial Medicine and Surgery on February 25, the name of the Society was officially changed to Industrial Medical Association of Upstate New York.

The following officers and directors were elected: President—MARVIN L. AMDUR, M.D.; President-Elect—GORDON M. HEMMET, M.D.; Vice-President—GEORGE A. HARDIE, M.D.; Secretary—DALLAS E. BILLMAN, M.D.; Treasurer—JEAN D. WATKEYS, M.D.; Directors—JOHN C. KINZLEY, M.D., and EDWARD C. RILEY, M.D.

The scientific program included a discussion of the New York State Medical Society's Committee on Industrial Health, by the Committee chairman, PETER J. DINATALE, M.D. JERMYN F. MCCAHAN, M.D., Medi-



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cal Director, Hawthorne Works, Western Electric Company, Chicago, presented a paper entitled "Absenteeism," which was followed by discussion by H. EDWIN DUDLEY, Wage and Salary Administrator, Stromberg-Carlson Division of General Dynamics, and JAMES H. STERNER, M.D., Medical Director, Eastman Kodak Company.

The afternoon program, presented by members of the University of Rochester Medical Center, was as follows: "The Executive Health Examination"—William S. McCann, M.D., The Charles A. Dewey Professor of Medicine, Emeritus; "A Philosophy Toward Occupational Backs"—Robert B. Duthie, M.D., Professor of Orthopaedic Surgery, and Chairman, Division of Orthopaedics; "Automatic Data Processing as an Aid to the Physician"—Lee B. Lusted, M.D., Associate Professor of Radiology, and Chairman, National Institute of Health Advisory Committee on Computers in Research.

► Northwest Association of Occupational Medicine recently elected A. JOHN NELSON, M.D., as President; FORREST E. RIEKE, M.D., as Vice-President, and GEORGE L. VOELZ, M.D., to the Board of Directors. W. D. NORWOOD, M.D., retiring President, has assumed chairmanship of the Board of Directors. Otherwise the membership of the Board remained unchanged. W. J. SITTNER, M.D., continues as Secretary-Treasurer.

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